FOR·THE·INCREASE·
AND·DIFFVSION·OF·
KNOWLEDGE·AMONG·MEN·
PER ORBEM
·SMITHSONIAN·
·INSTITVTION·
WASHINGTON·1846·

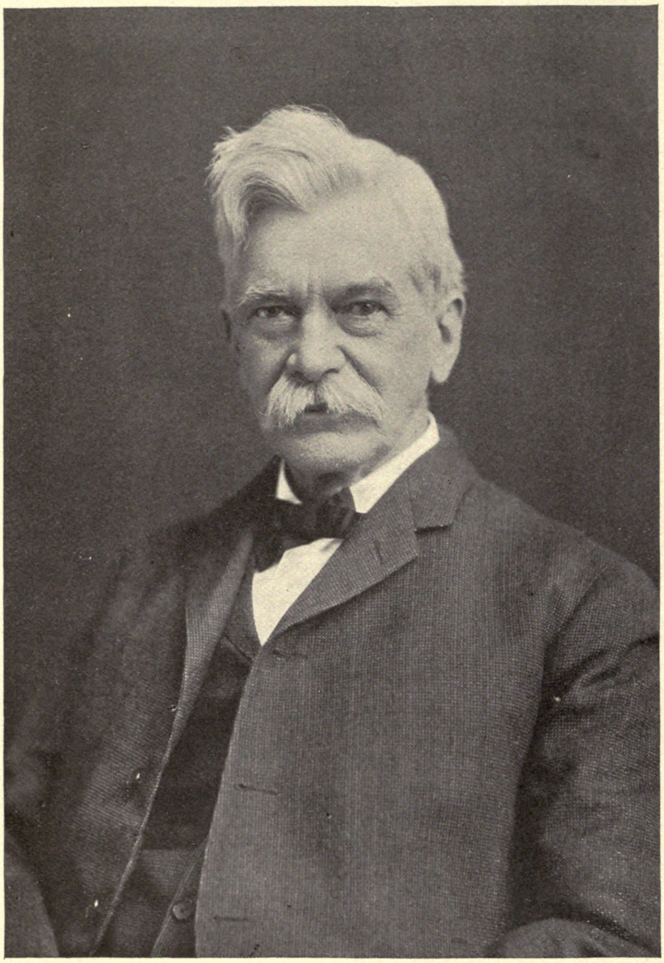
BERKELEY
LIBRARY
UNIVERSITY OF
CALIFORNIA

PALEONTOLOGY LIBRARY

EARTH
SCIENCES
LIBRARY

W. K. Fisher
Aug. 1914

1 6 5d/--



A. E. Verrill

SMITHSONIAN INSTITUTION

HARRIMAN ALASKA SERIES

VOLUME XIV

Monograph of the Shallow-water Starfishes of the North Pacific Coast from the Arctic Ocean to California

(WITH 110 PLATES)

BY

ADDISON EMERY VERRILL

Professor Emeritus of Yale University

PART 2. PLATES

(PUBLICATION 2140)

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION
1914

EARTH
SCIENCES
LIBRARY

PALEONTOLOGY

addl
Cat as sep

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

QL383
.1
V4
v.2

PALEO.
LIBRARY

EARTH
SCIENCES
LIBRARY

Shallow-water Starfishes of the North Pacific Coast from the Arctic Ocean to California

PLATES I–CX WITH EXPLANATIONS

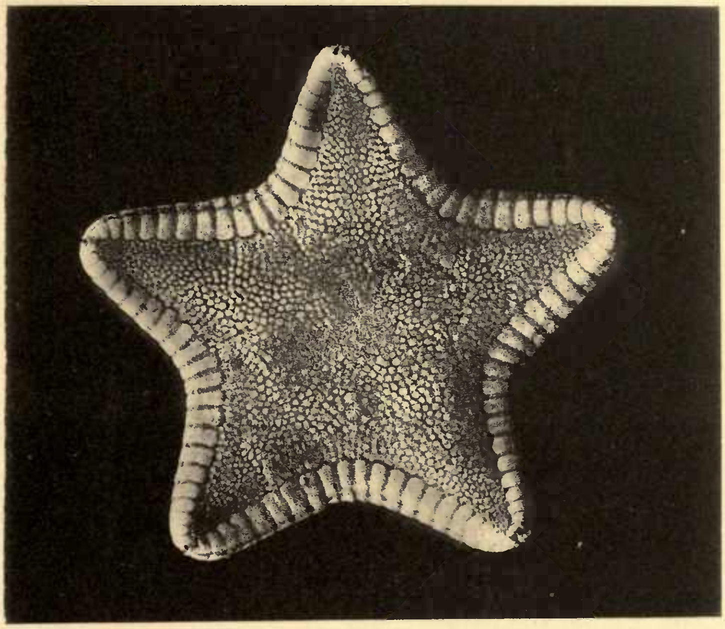
M886282

PLATE I.

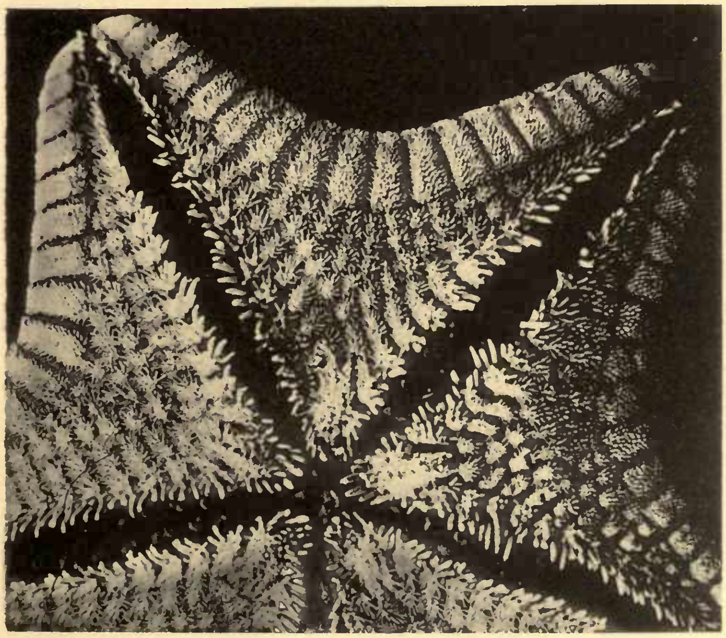
FIG. 1. *Glyphaster anomalus* (Fisher). Dorsal side; × 2.

FIG. 2. The same specimen. Actinal side; × 4. Alaska, Harriman Expedition.

1



2



1, 2. Glyphaster anomalus (Fisher)

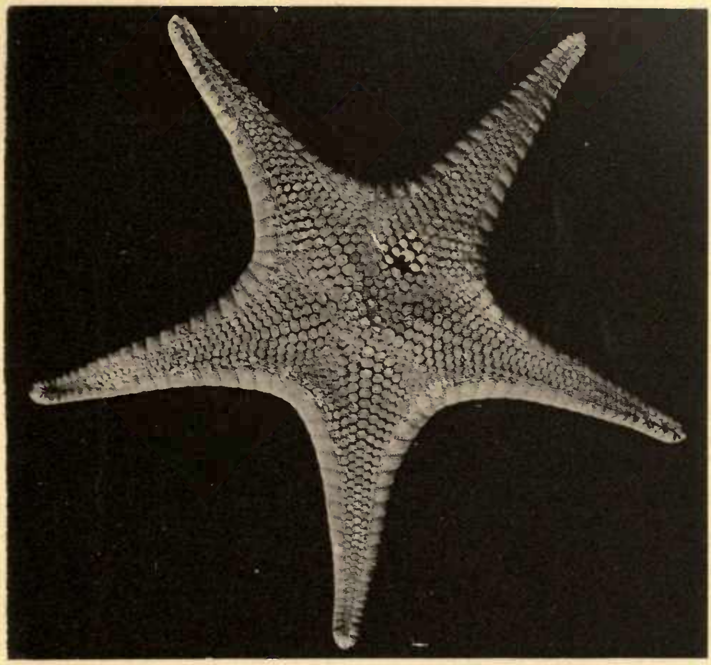
2

PLATE II.

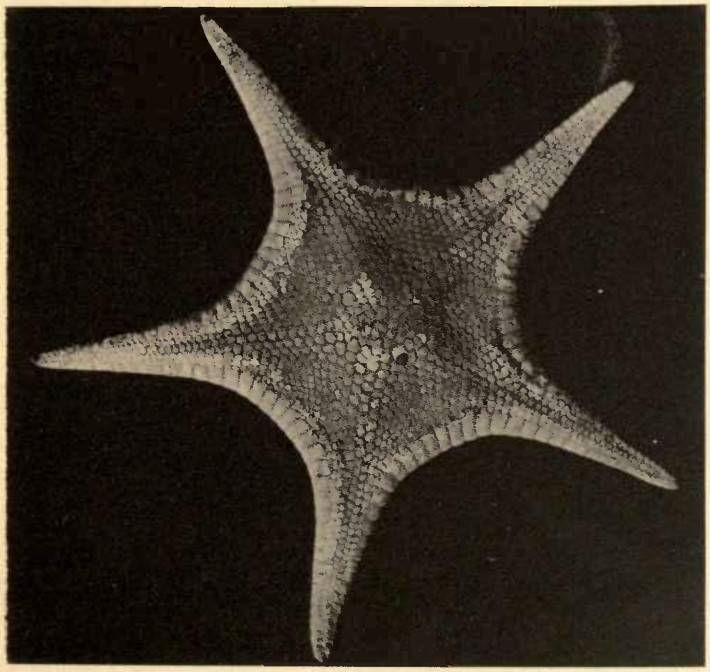
Fig. 1. ***Mediaster æqualis*** Stimpson. Dorsal side; about natural size.

Fig. 2. ***Mediaster bairdii*** Verrill. Type. Dorsal side; about natural size.

1



2



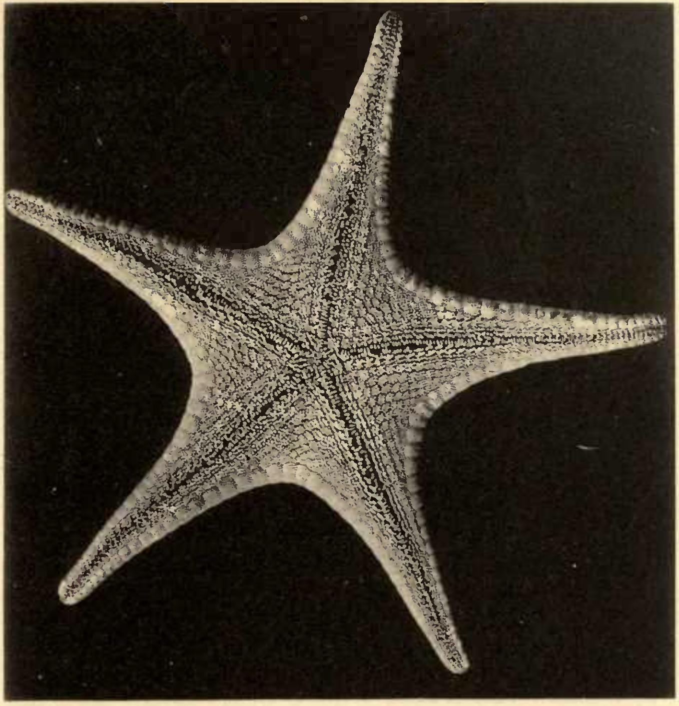
1. MEDIASTER ÆQUALIS Stimpson
2. MEDIASTER BAIRDII Verrill. Type

3

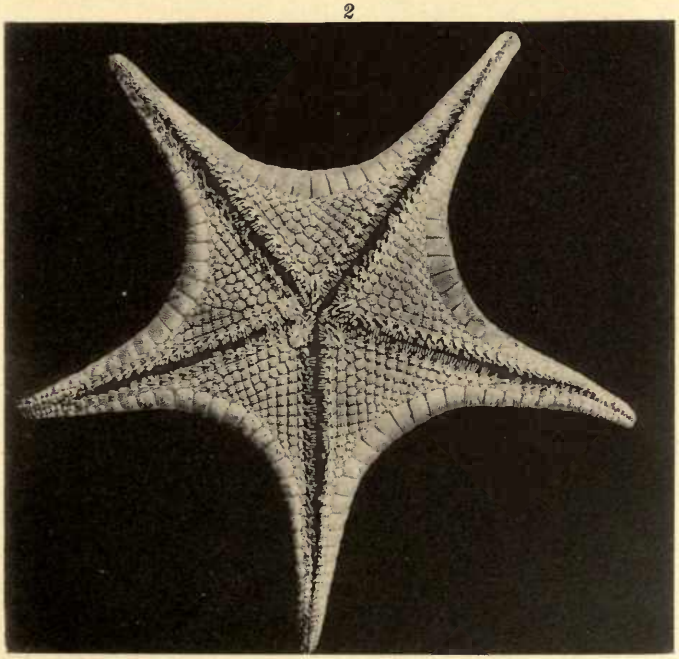
PLATE III.

FIG. 1. *Mediaster æqualis* Stimpson. Ventral side; about natural size.
FIG. 2. *Mediaster bairdii* Verrill. Type. Ventral side; about natural size.

1



2



1. Mediaster æqualis Stimpson
2. Mediaster bairdii Verrill. Type

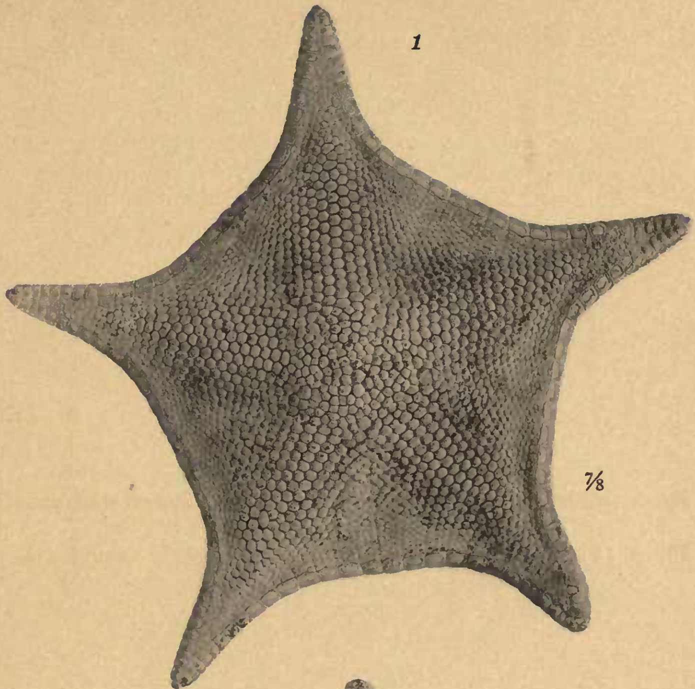
4

PLATE IV.

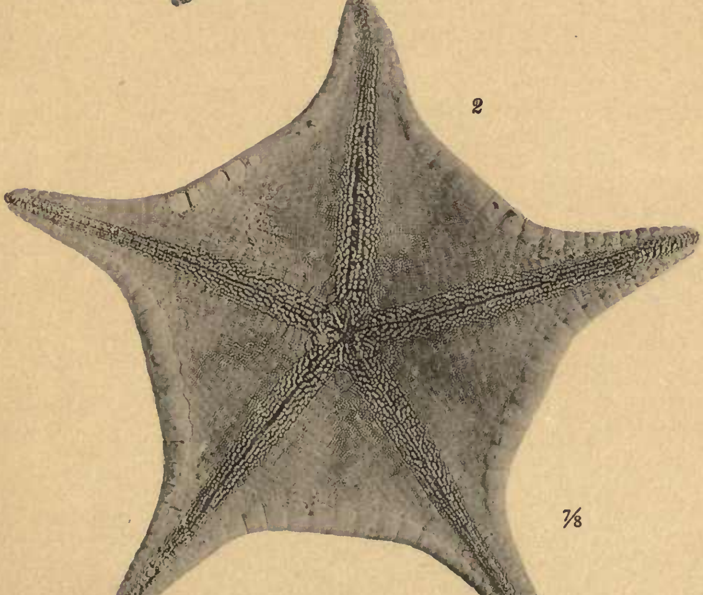
FIG. 1. *Ceramaster granularis* (Retz.) Verrill. Dorsal side; about 7/8 natural size. West Atlantic. Station 2506.

FIG. 2. The same specimen. Ventral side; about 7/8 natural size.

1



2



1, 2. Ceramaster granularis (Retz.)

5

PLATE V.

Fig. 1. *Henricia leviuscula,* var. *spatulifera* Verrill. Type. One of the actinal interradial areas, jaws, and proximal adambulacral spines; × 6. Monterey. Yale Mus.

Fig. 2. *Crossaster papposus* (Linn.) M. & Trosch. An interradial area and jaw; enlarged.

Figs. 3, 4. *Mediaster æqualis* Stimpson. Portions of dorsal and actinal sides of a ray; × 6.

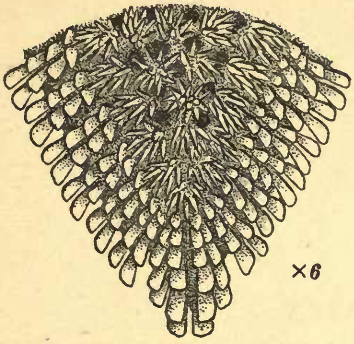
Fig. 5. The same. Portion of dorsal side of a ray with spinules removed, showing plates and papular areas; × 8.

Fig. 6. *Ctenodiscus crispatus* (Retz.) D. & Kor. Portion of an interradial area, inferomarginal plates, and jaws; after Ludwig, from a Bering Sea specimen; × 4.

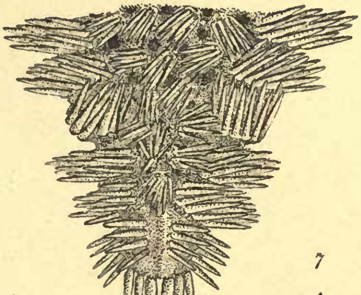
Fig. 7. The same. Front view of upper and under marginal plates; × 5. From the same.

Figs. 8, 8*a*. The same. One of the fasciolar spinules, side and profile views; × 120. From the same.

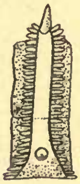
1



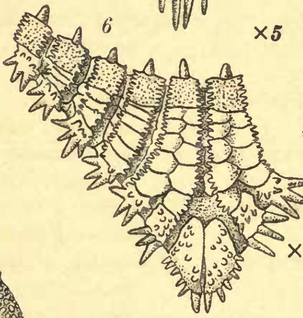
2



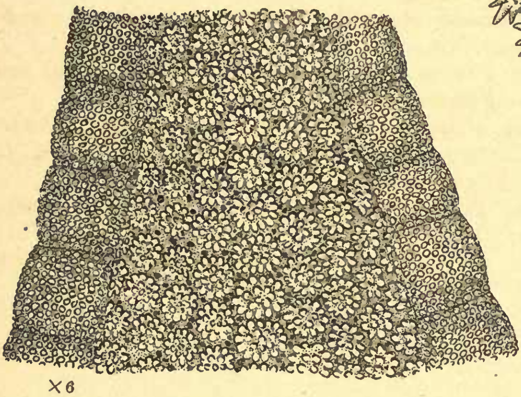
7



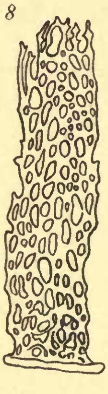
6



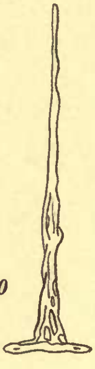
3



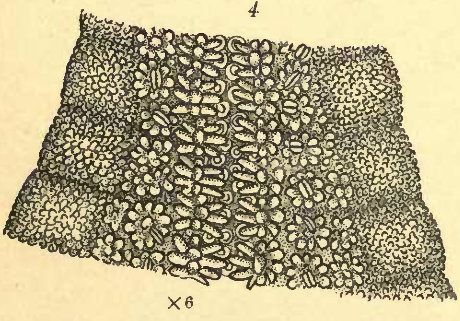
8



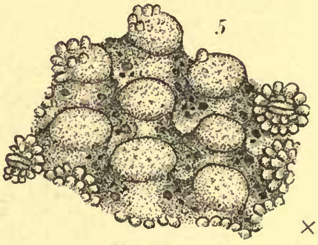
8 a



4



5



1. Henricia leviuscula, var. spatulifera Verrill. Type
2. Crossaster papposus (Linn.)
3, 4, 5. Mediaster æqualis Stimpson
6, 7, 8. Ctenodiscus crispatus (Retz.)

6

PLATE VI.

Fig. 1. *Glyphaster anomalus* (Fisher) Verrill. Actinal side; × 1⅖. British Columbia.

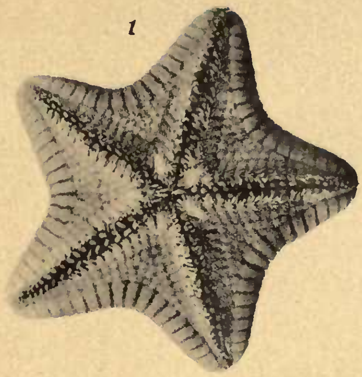
Fig. 2. The same specimen. Dorsal side; × 1⅖.

Fig. 3. *Dermasterias imbricata* (Grube) Perrier. A young specimen, six-rayed. Dorsal side; × 1⅓.

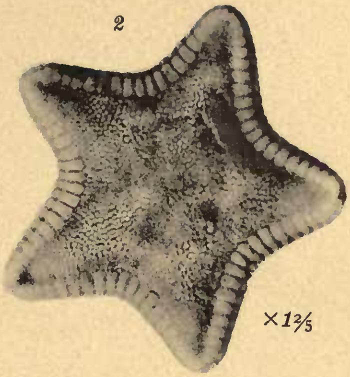
Fig. 4. The same, adult. Details of ventral side; *P, P,* pedicellariæ; × 2.

Fig. 5. The same specimen. Portion more enlarged. *P, P,* bivalved pedicellariæ; *P′, P′,* trivalved pedicellariæ; × 4.

1

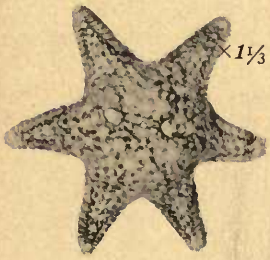


2



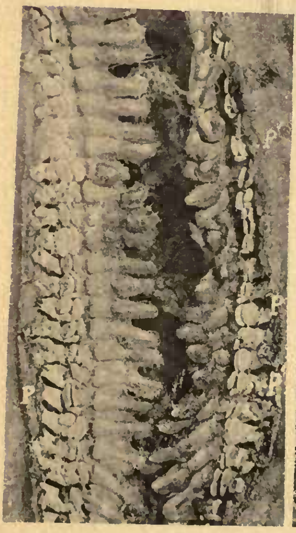
×1⅖

3

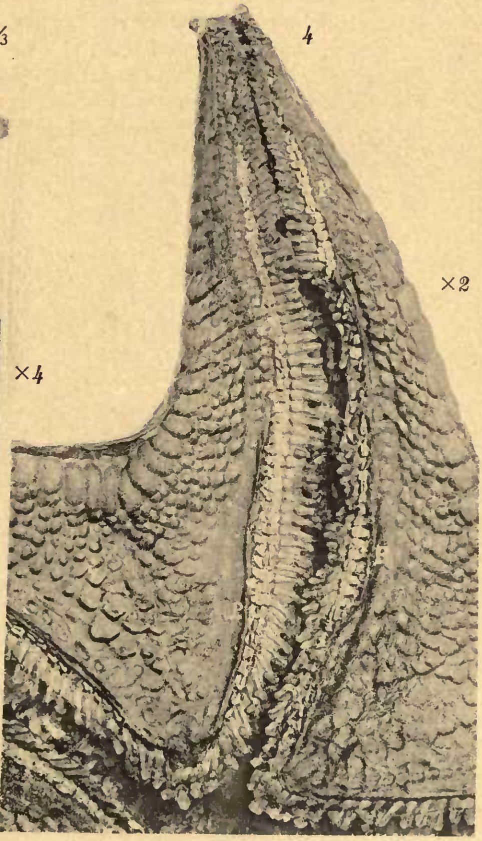


4

5



×4



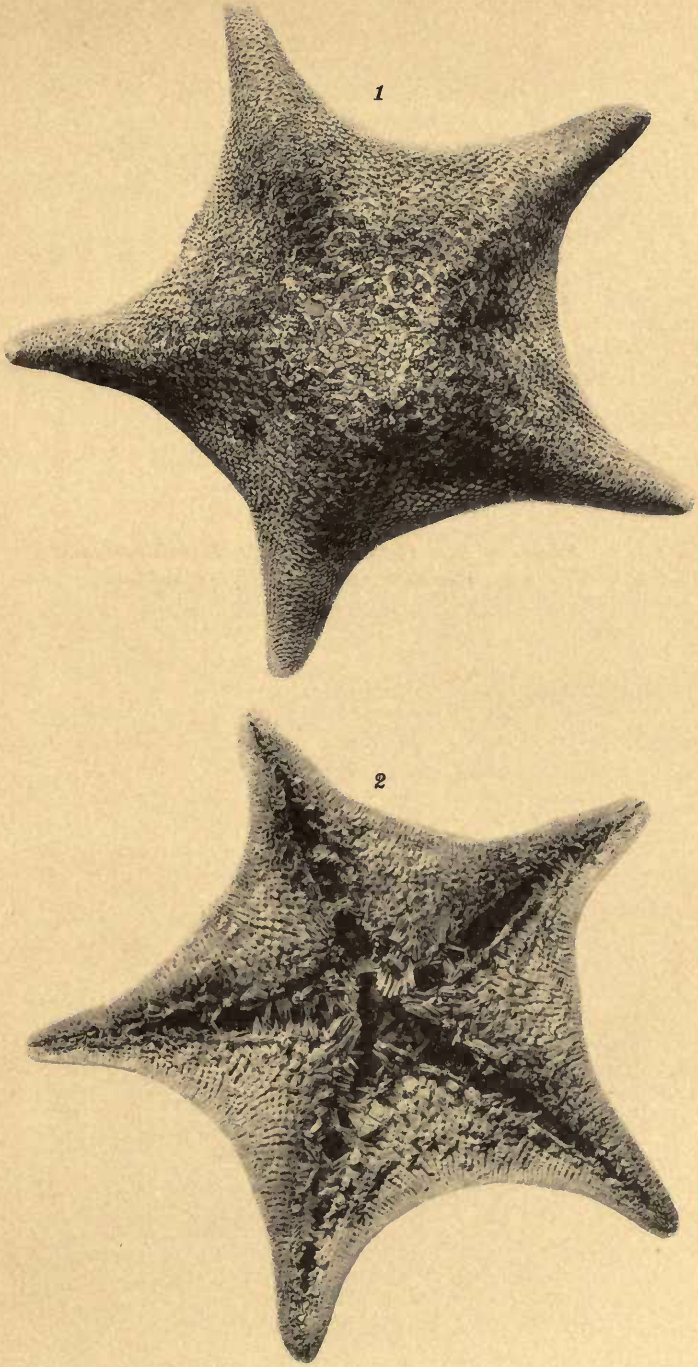
×2

1, 2. Glyphaster anomalus (Fisher)
3. Dermasterias imbricata (Grube). A young six-rayed specimen
4, 5. The same, adult. Details of ventral side

7

PLATE VII.

FIG. 1. *Patiria miniata* (Brandt) Verrill. Dorsal side; about ¾ natural size.
FIG. 2. The same specimen. Ventral side. Yale Mus.



1, 2. Patiria miniata (Brandt)

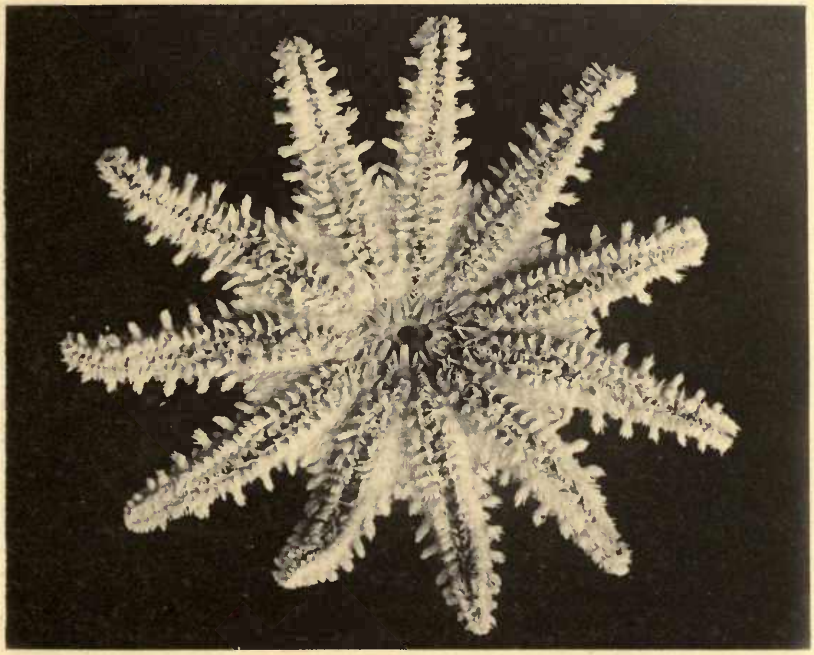
8

PLATE VIII.

Fig. 1. *Crossaster papposus* (Linn.) M. & Troschel. A young specimen, in alcohol. Ventral side; × 1¾.

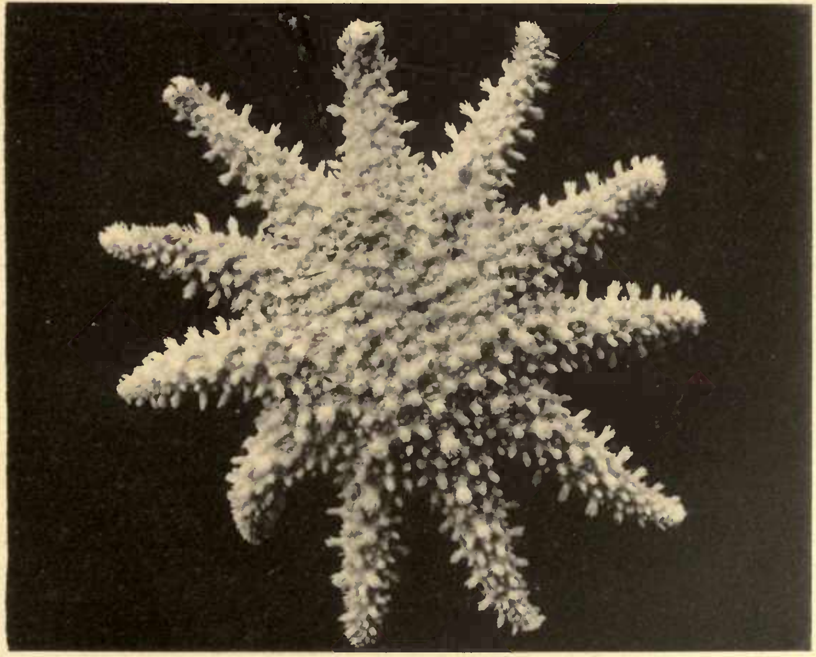
Fig. 2. The same specimen. Dorsal side; × 1⅗. Berg Bay. Yale Mus.

1



×1¾

2



1, 2. Crossaster papposus (Linn.)

9

PLATE IX.

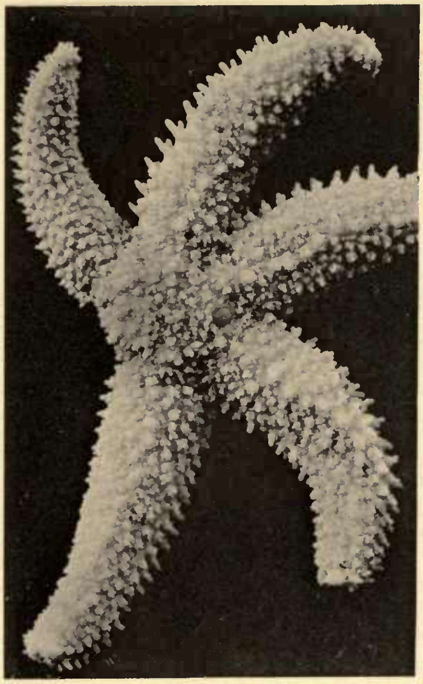
FIG. 1. *Leptasterias coei* Verrill. Type. In alcohol; × 2½. Alaska, Harriman Expedition. Yale Mus.

FIG. 2. *Solaster endeca* (Linn.) Forbes. Young. Dorsal side; × 1⅛. Harriman Expedition.

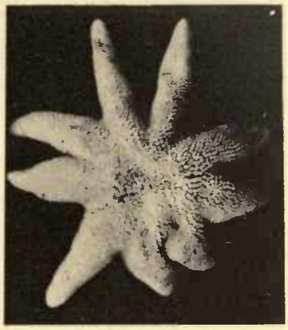
FIG. 3. The same specimen. Ventral side; × 1⅛. Juneau, 20 fathoms.

FIG. 4. *Crossaster papposus* (Linn.) M. & Troschel. Details of dorsal side of a young specimen in alcohol; × 2⅔. Berg Bay, Harriman Expedition. Yale Mus.

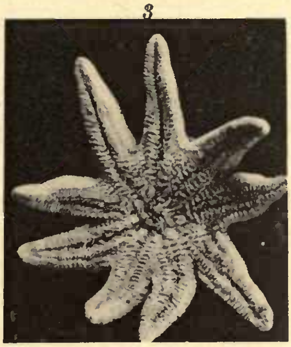
1



2



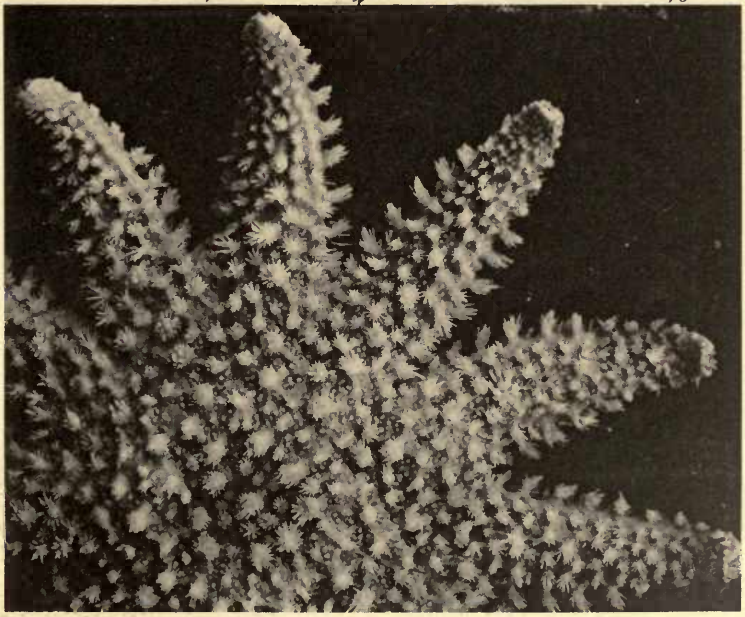
3



×2½

×1⅛

4



×2⅔

1. Leptasterias coei Verrill. Type
2, 3. Solaster endeca (Linn.)
4. Crossaster papposus (Linn.)

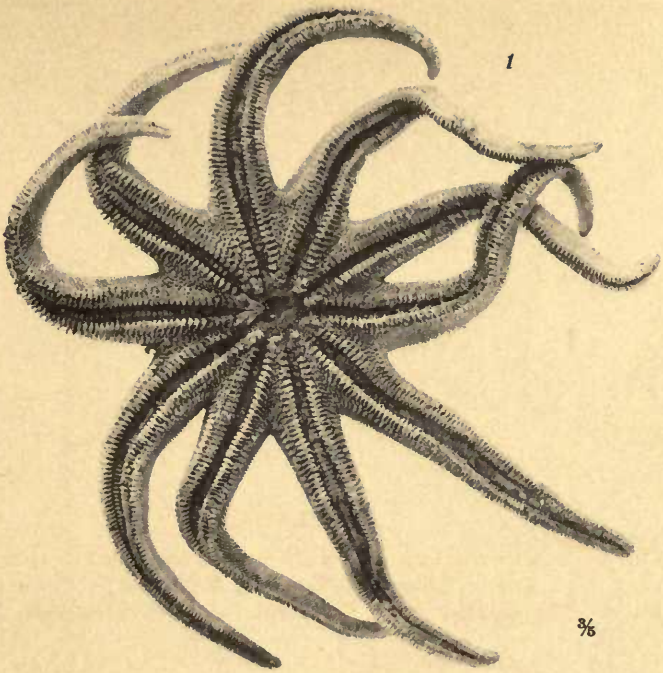
10

PLATE X.

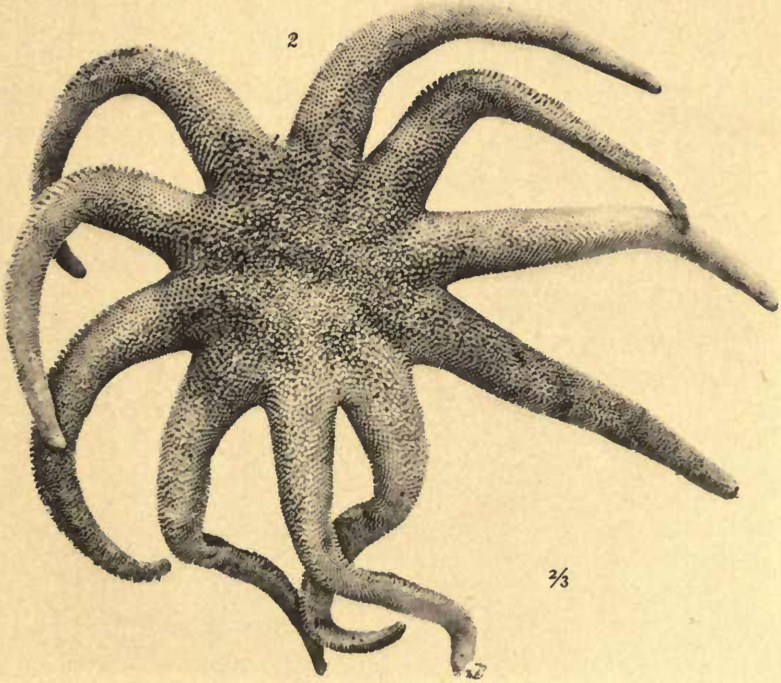
FIG. 1. *Solaster stimpsoni* Verrill. Type. Actinal side; about ⅗ natural size. British Columbia. No. 5136. Yale Mus.

FIG. 2. The same specimen. Dorsal side; about ⅔ natural size.

1



2



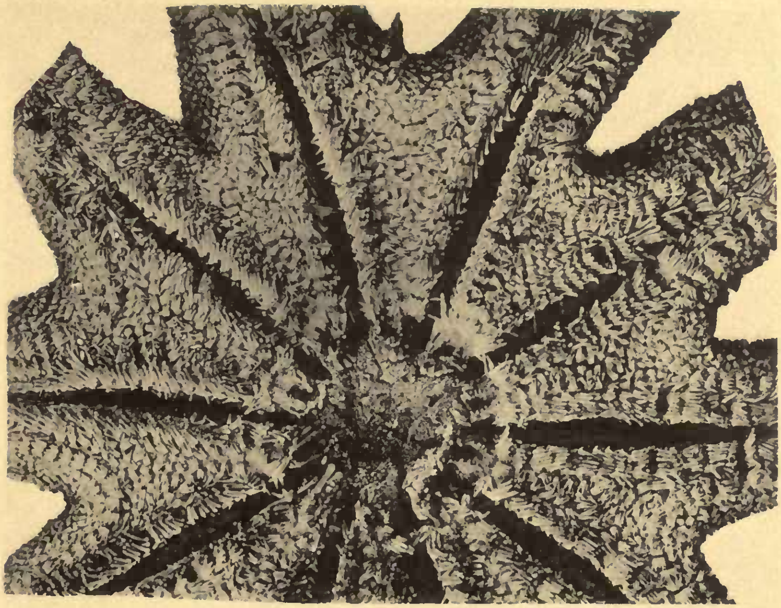
1, 2. Solaster stimpsoni Verrill. Type. No. 5407, Yale Mus.

//

PLATE XI.

FIG. 1. *Solaster stimpsoni* Verrill. Cotype. Details of actinal side; × 1⅘.
FIG. 2. The same specimen. Dorsal side; × 1⅘.

1



×1⅘

2

1, 2. Solaster stimpsoni Verrill. Cotype

12

PLATE XII.

FIG. 1. *Henricia tumida* Verrill. Type. Dorsal side; × 1⅕. Yale Mus.

FIG. 2. The same specimen. Actinal side; × 1¼.

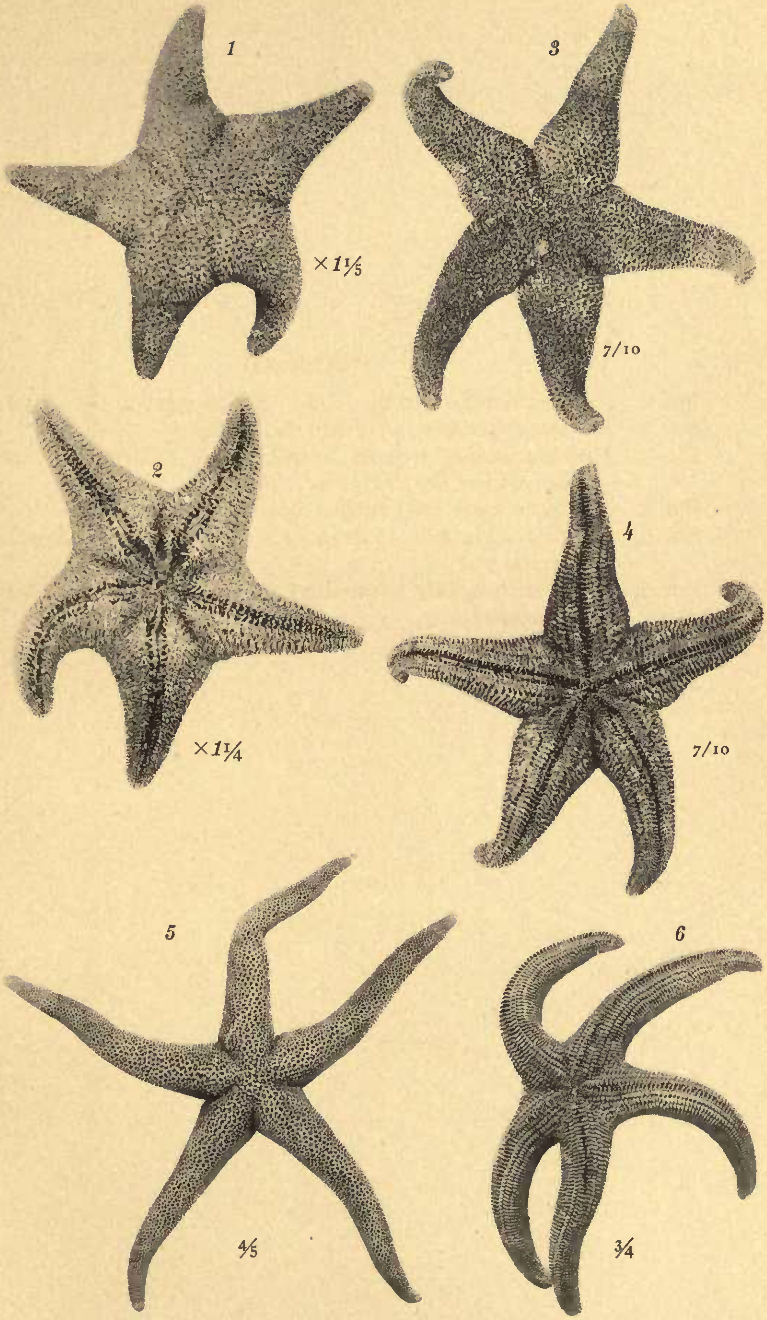
FIG. 3. *Henricia tumida borealis* Verrill. Type. Dorsal side; about 7/10 natural size Dutch Harbor. Yale Mus.

FIG. 4. The same specimen. Actinal side; 7/10 natural size.

FIG. 5. *Henricia leviuscula* (Stimpson). Typical form. Dorsal side; ⅖ natural size.

FIG. 6. *Henricia leviuscula* (Stimpson), var. *dyscrita* Fisher. Actinal side; ¾ natural size.

PLATE XII



1, 2. Henricia tumida Verrill. Type
3, 4. Henricia tumida borealis Verrill. Type
5. Henricia leviuscula (Stimpson)
6. Henricia leviuscula (Stimpson), var. dyscrita Fisher

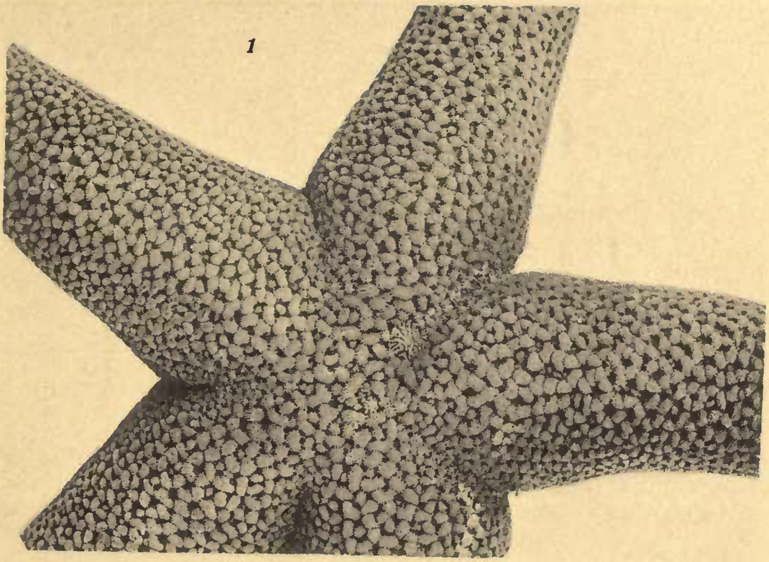
13

PLATE XIII.

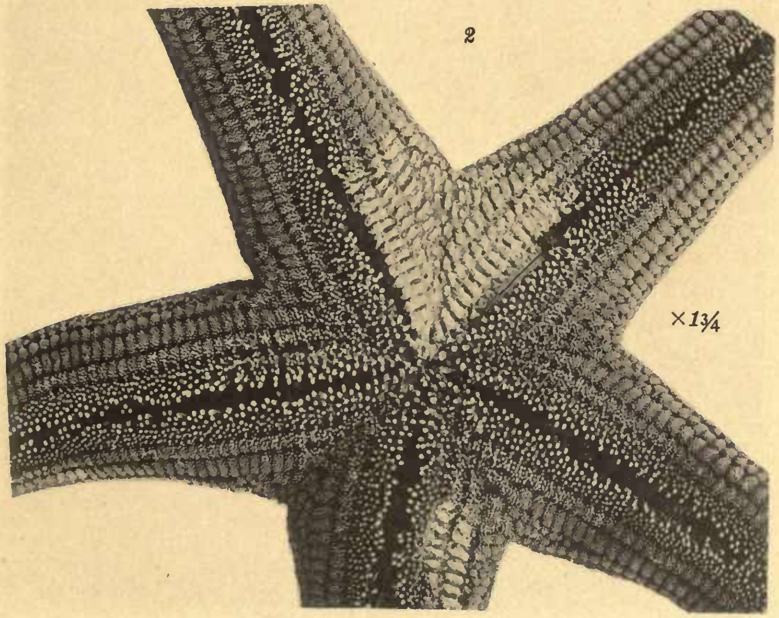
FIG. 1. *Henricia leviuscula* (Stimpson). Details of dorsal side of the typical form; × 1¾. Yale Mus.

FIG. 2. The same specimen. Ventral side; with spines partly removed; × 1¾. Yale Mus.

1



2



×1¾

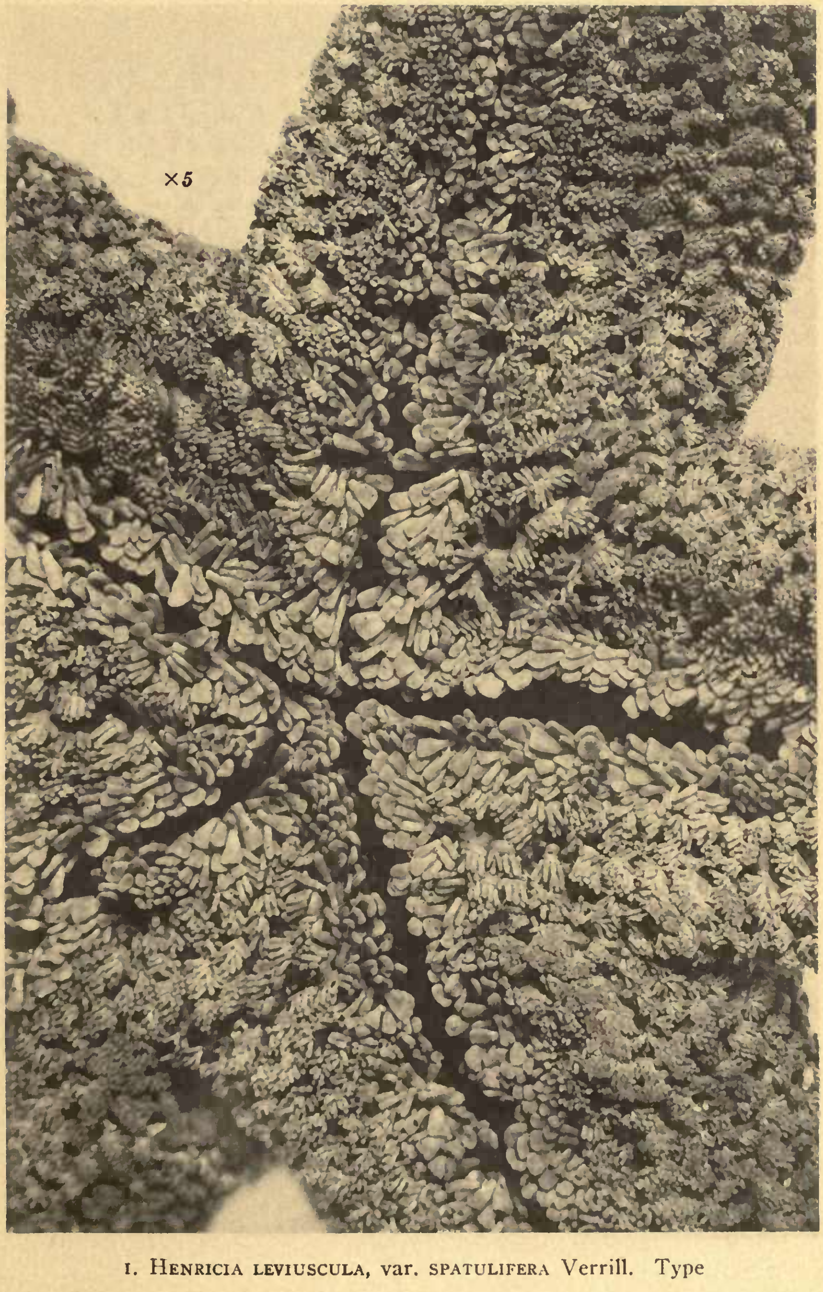
1, 2. Henricia leviuscula (Stimpson)

14

14

PLATE XIV.

FIG. 1. *Henricia leviuscula,* var. *spatulifera* Verrill. Type. Details of ventral side; × 5. Monterey, Calif. Yale Mus., No. 2238.



1. Henricia leviuscula, var. spatulifera Verrill. Type

15

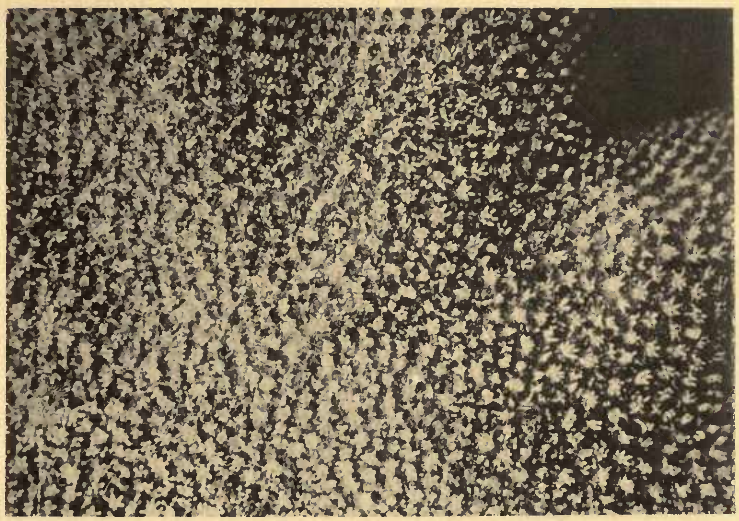
15

PLATE XV.

FIG. 1. *Solaster stimpsoni* Verrill. Type. Same specimen as on pl. x (No. 5407, Yale Mus.). Details of dorsal side of disk; × 3. Yale Mus.

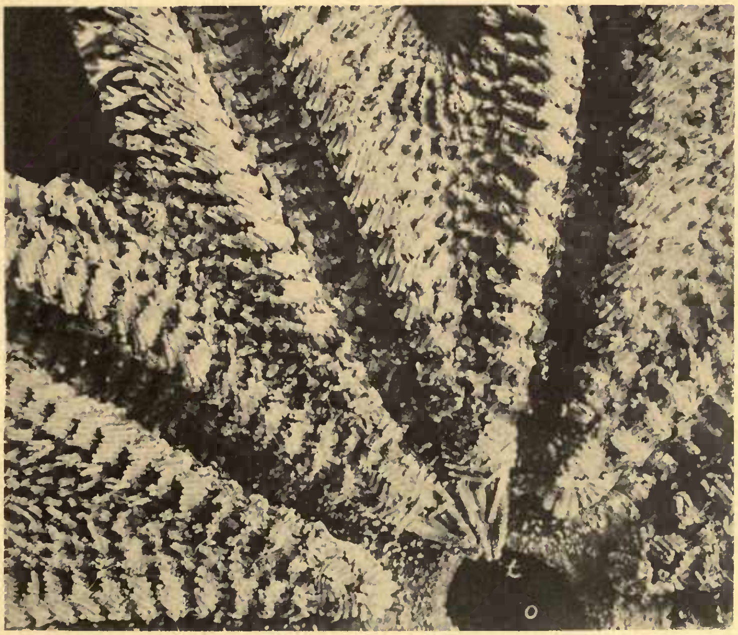
FIG. 2. The same specimen. Details of actinal side; *O*, mouth; *t*, peroral spines; × 3.

1



2

×3



1, 2. Solaster stimpsoni Verrill. Type. No. 5407, Yale Mus.

16

16

PLATE XVI.

FIG. 1. *Leptasterias epichlora alaskensis,* var. *carinella* Verrill. Young. Dorsal side; natural size.

FIG. 2. The same specimen. Actinal side; natural size. Yale Mus.

Type FIG. 3. The same, var. *siderea* Verrill. Type. Dorsal side; about natural size.

FIG. 4. The same specimen. Actinal side; about natural size. Yale Mus.

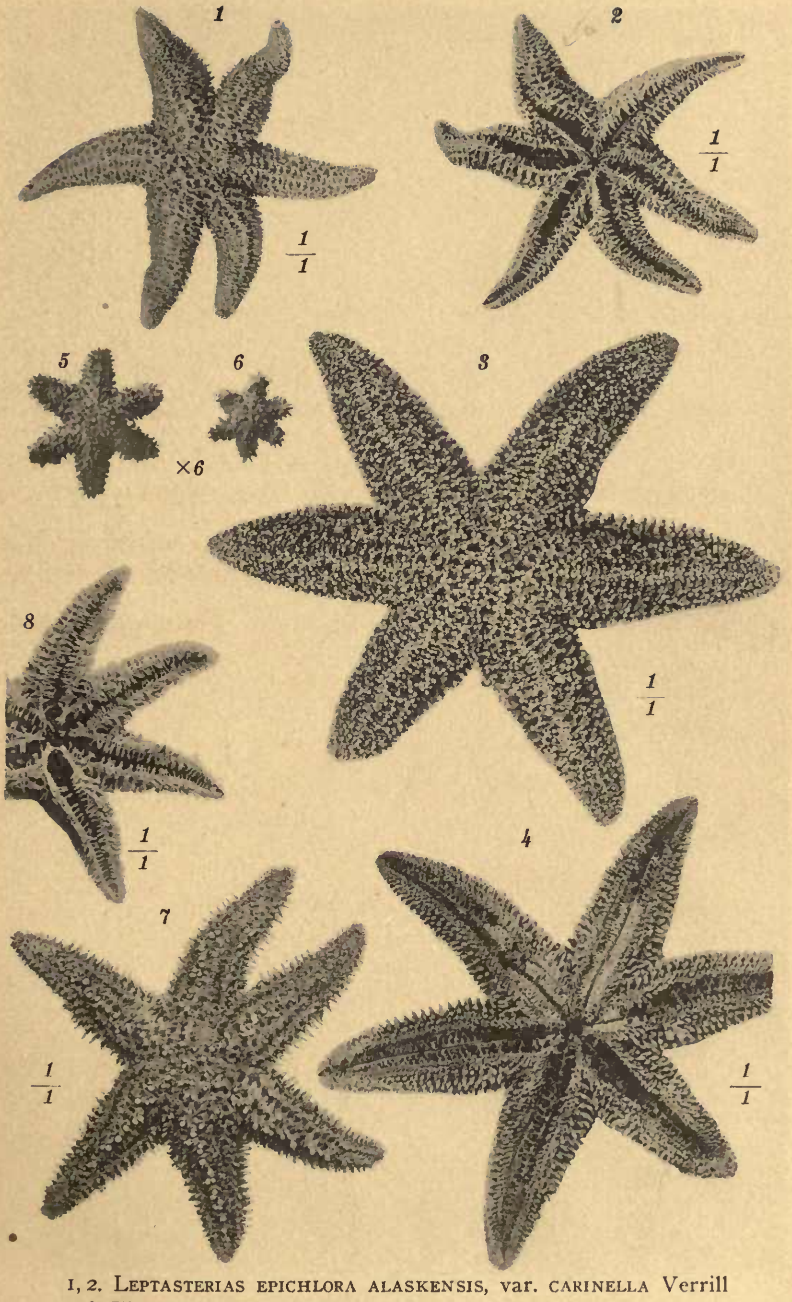
FIGS. 5–6. The same. Very young stages; much enlarged (× about 6). Yale Mus.

Type FIG. 7. *Leptasterias dispar* Verrill. Type. Dorsal side; about natural size. Yale Mus.

FIG. 8. *Leptasterias æqualis* (Stimpson), var. Ventral side; about natural size.

16

2 Sup.



alaskensis var

var siderea
Type

aequalis

siderea

dispar
Type

1, 2. Leptasterias epichlora alaskensis, var. carinella Verrill
3-6. The same, var. siderea Verrill. Type
7. Leptasterias dispar Verrill. Type
8. Leptasterias æqualis (Stimpson), var.

17

17

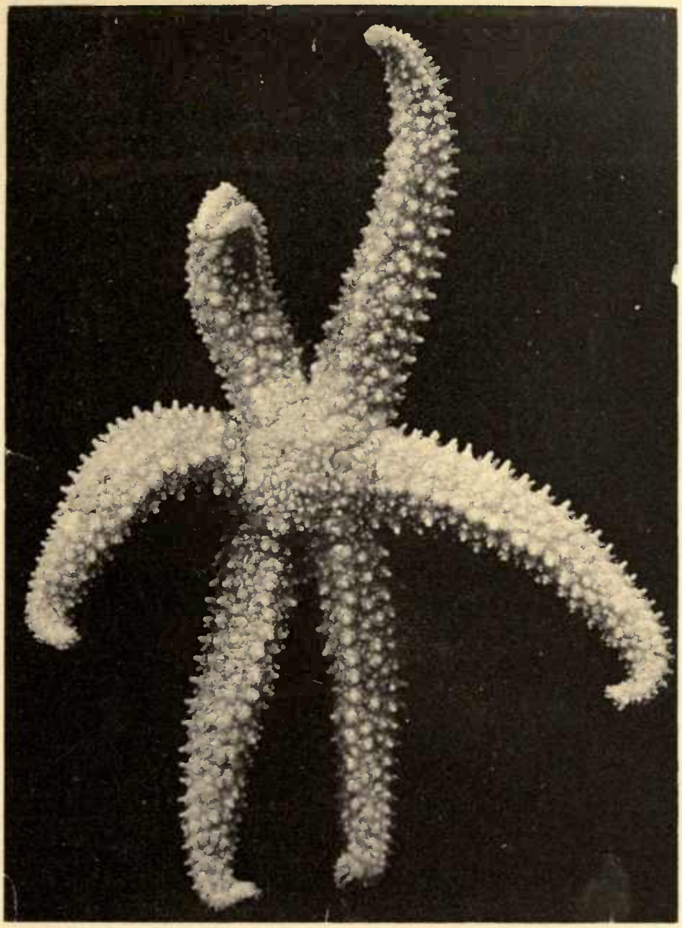
PLATE XVII.

FIG. 1. *Leptasterias coei* Verrill. Type. In alcohol. Dorsal side; × 2¼. Berg Bay. Yale Mus.

FIG. 2. The same. Cotype. Specimen with shorter rays from Berg Bay. Actinal view; × 2¼. Yale Mus.

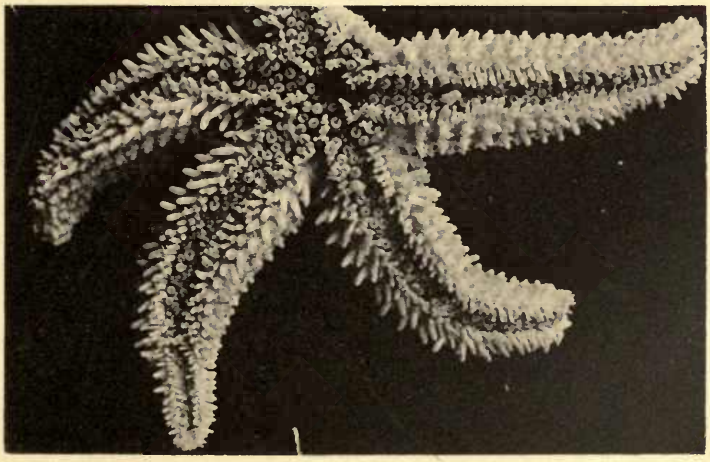
17

1



×2¼

2



×2¼

1, 2. Leptasterias coei Verrill. Type. Berg Bay. Yale Mus.

18

18

PLATE XVIII.

FIG. 1. *Leptasterias æqualis* (Stimpson). Typical form, from Monterey Bay. Actinal side; × 1⅞.

FIG. 2. The same specimen. Dorsal side; × 1⅓.

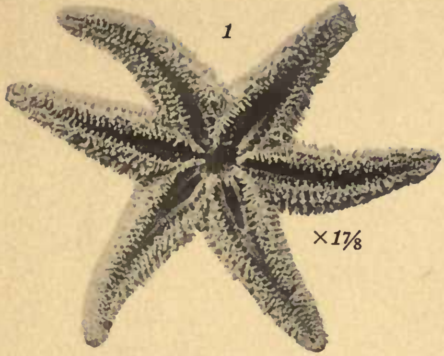
FIG. 3. *Leptasterias leptalea* Verrill. Type. Ventral side; × 1⅘. Sitka. Yale Mus.

FIG. 4. *Orthasterias merriami* Verrill, sp. nov. Type. Dorsal side; about natural size.

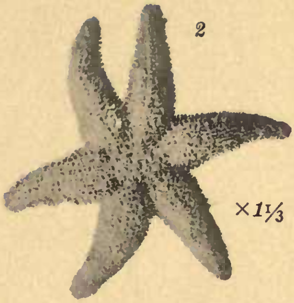
FIG. 5. The same specimen. Details. Actinal side; natural size. Juneau. Univ. of Calif.

18

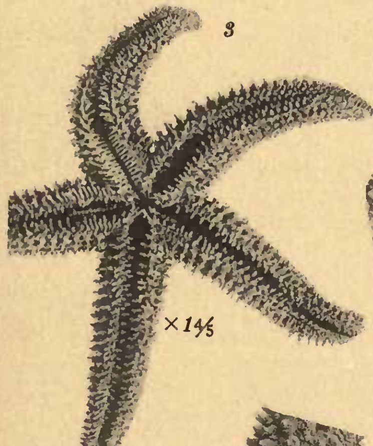
1



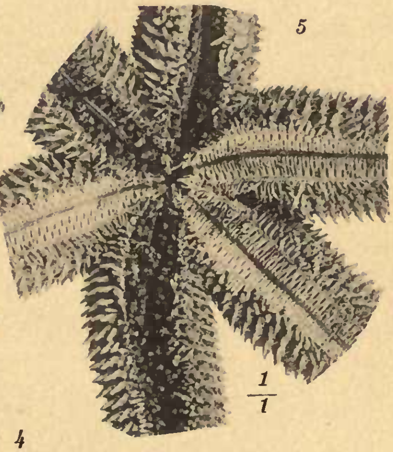
2



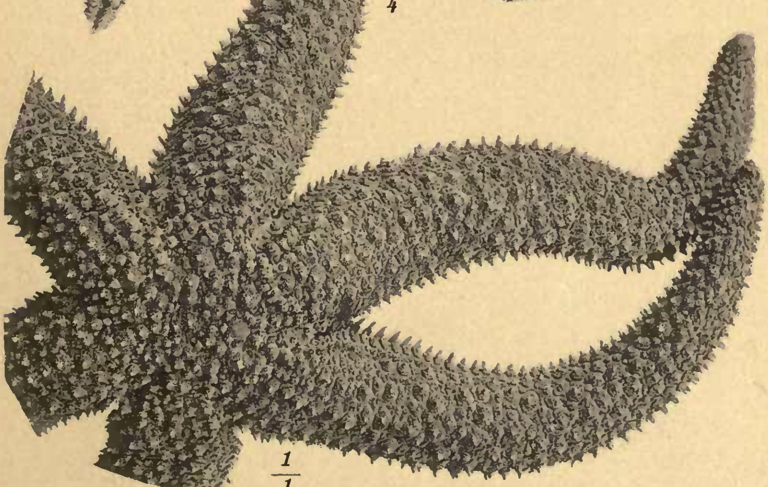
3



5



4



1, 2. Leptasterias æqualis (Stimpson)
3. Leptasterias leptalea Verrill. Type
4, 5. Orthasterias merriami Verrill. Type

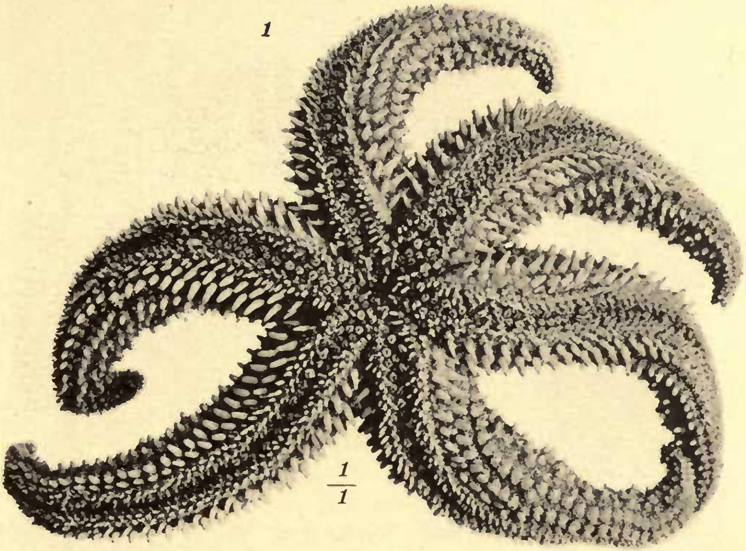
19

PLATE XIX.

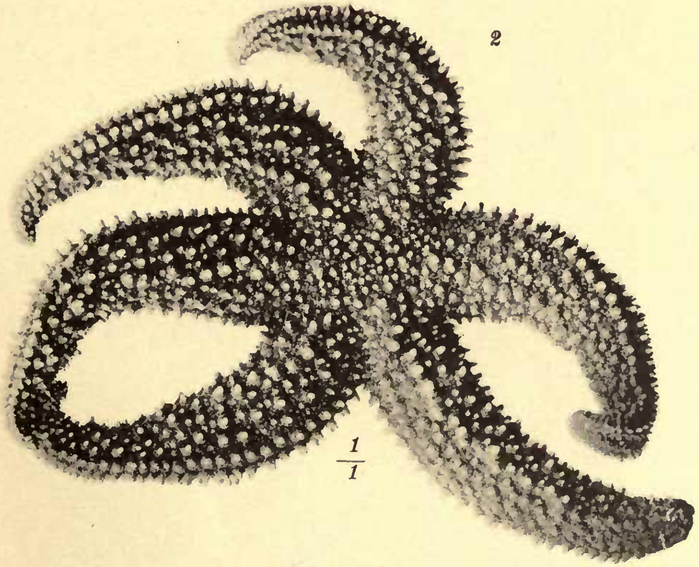
FIG. 1. *Orthasterias merriami* Verrill. Type. In alcohol. Actinal side; natural size. Glacier Bay.

FIG. 2. The same specimen. Dorsal side. Yale Mus.

1



2



1, 2. Orthasterias merriami Verrill. Cotype

20

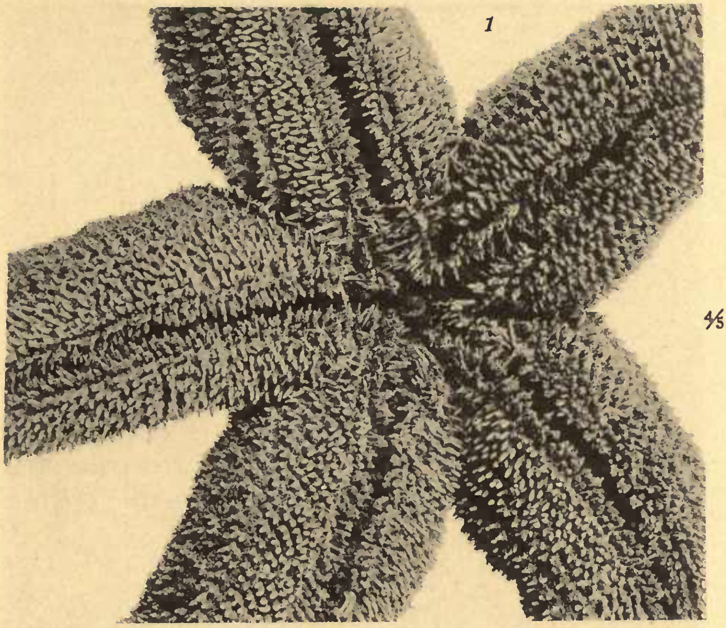
20

PLATE XX.

FIG. 1. *Evasterias acanthostoma* Verrill. Type. Actinal side; ⅘ natural size.

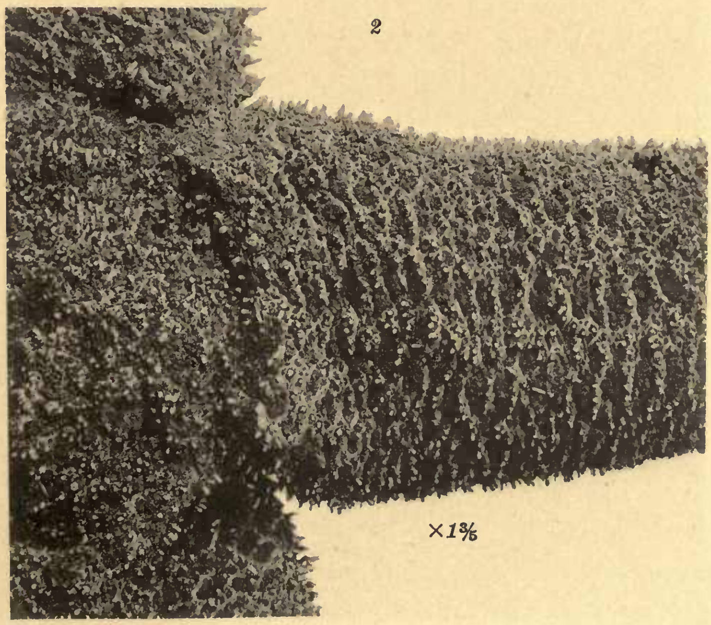
FIG. 2. The same specimen. Portion of dorsal side; × 1⅗. Popof Is., Alaska. Professor Ritter, Univ. Calif.

1



4/5

2



×1 3/5

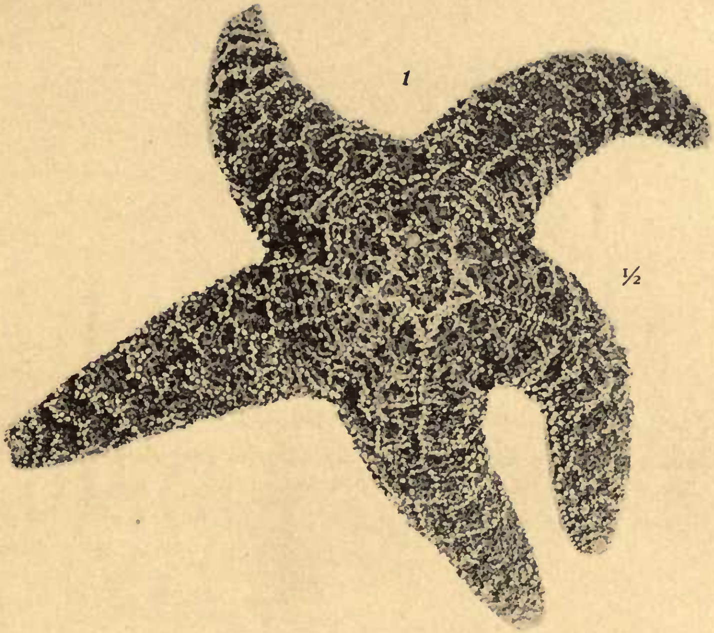
1, 2. Evasterias acanthostoma Verrill. Type

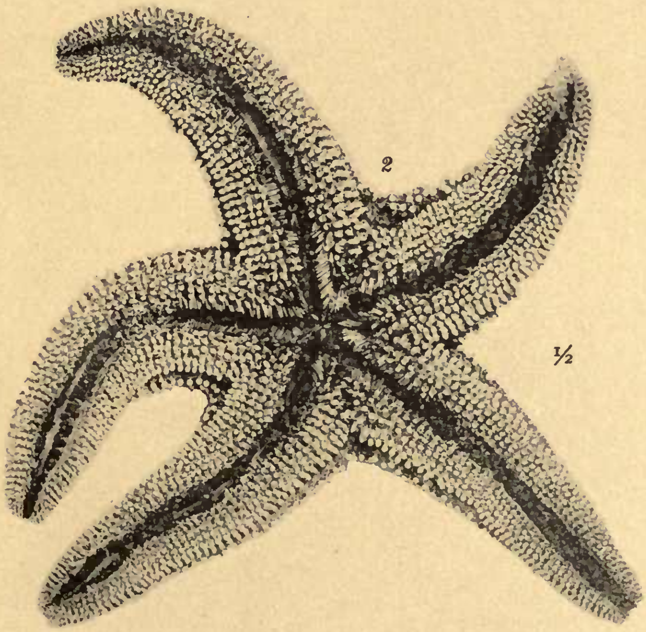
21

PLATE XXI.

FIG. 1. *Pisaster ochraceus* (Brandt). Dorsal side; about ½ natural size.
FIG. 2. The same. Actinal side; ½ natural size.

21





1, 2. PISASTER OCHRACEUS (Brandt)

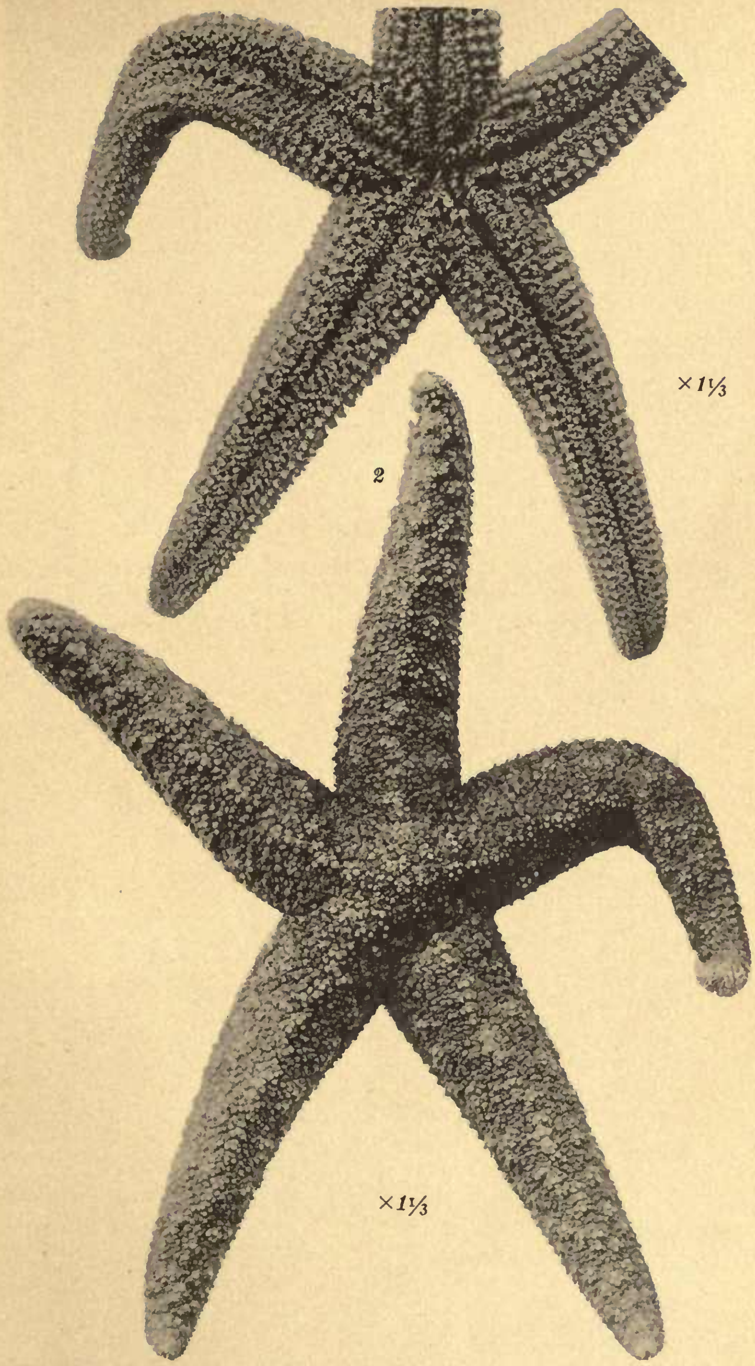
22

22

PLATE XXII.

FIG. 1. *Evasterias troschelii* (Stimpson). Typical form, in alcohol. Actinal side; × 1⅓.

FIG. 2. The same specimen. Dorsal side; × 1⅓. Sitka. Yale Mus.



1, 2. Evasterias troschelii (Stimpson)

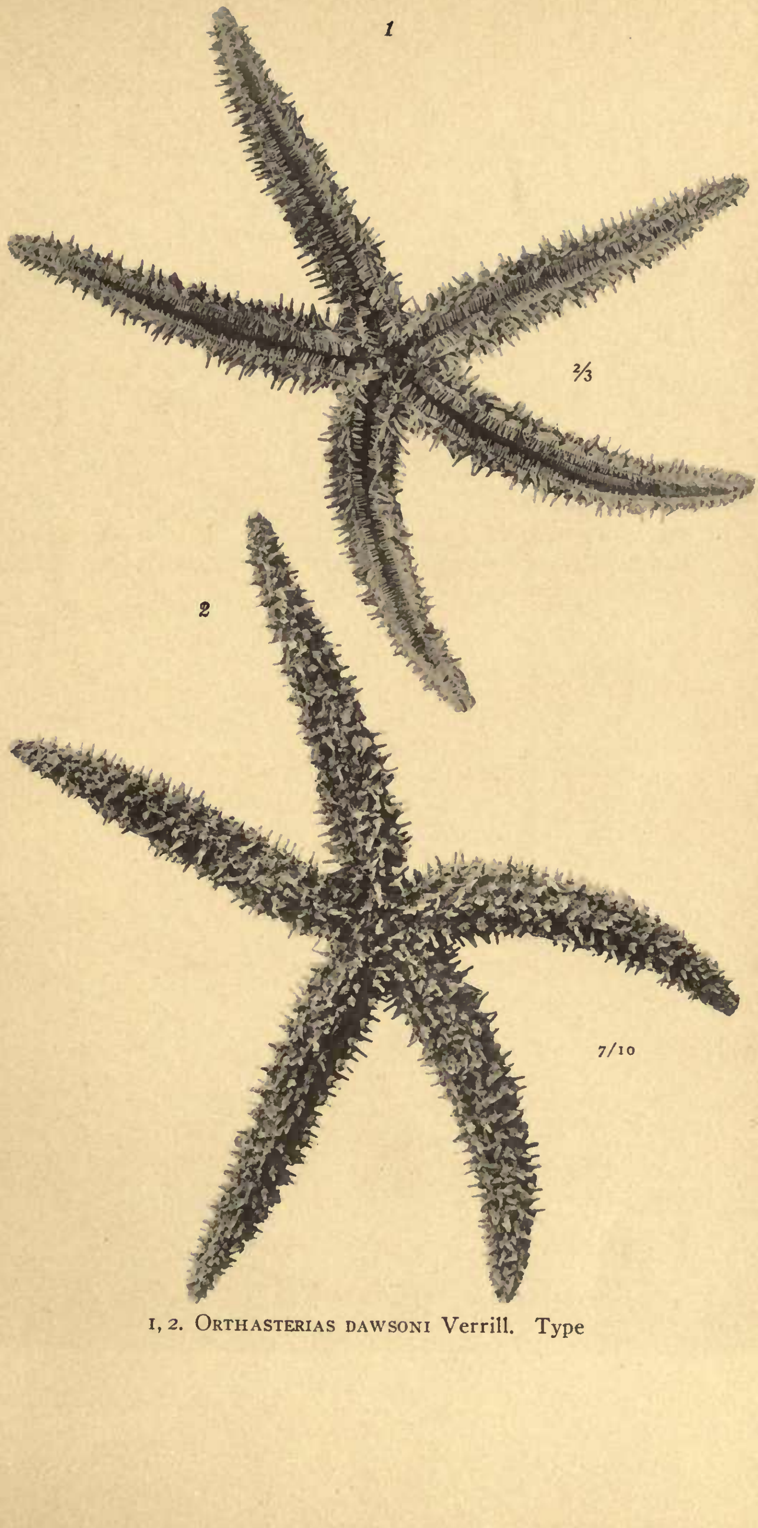
23

23

PLATE XXIII.

FIG. 1. *Orthasterias dawsoni* Verrill. Type. Ventral side; ⅔ natural size.

FIG. 2. The same specimen. Dorsal side; 7/10 natural size. British Columbia, Canadian Geol. Survey.



1, 2. ORTHASTERIAS DAWSONI Verrill. Type

24

24

PLATE XXIV.

FIG. 1. *Orthasterias columbiana* Verrill. Type. In alcohol. Actinal side of a ray; × 1⅞.

= merriami.

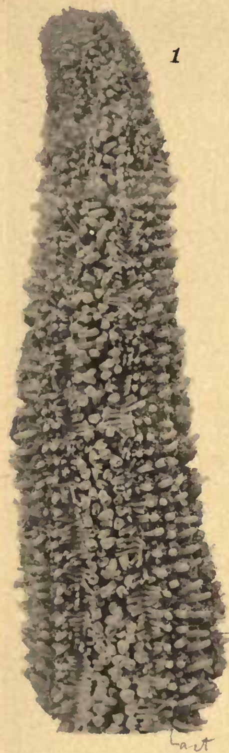
FIG. 2. The same specimen. Dorsal side of a ray; × 1⅞. Yale Mus. Same specimen as pl. XIX. 1

FIG. 3. *Evasterias acanthostoma* Verrill. Type. Part of a ray (dry), side view; about natural size. Univ. Calif.

FIG. 4. *Orthasterias columbiana* Verrill. Details of actinal side; × 1⅖. Yakutat, Alaska. Yale Mus.

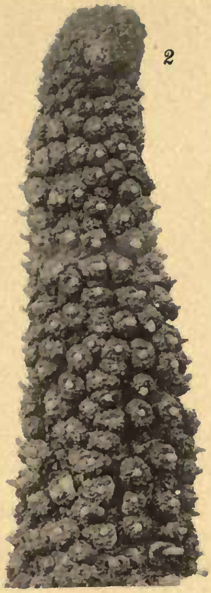
24

1



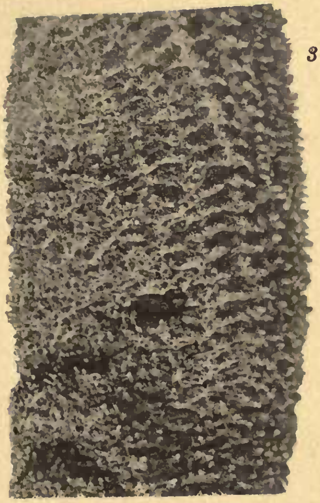
×1⅞

2



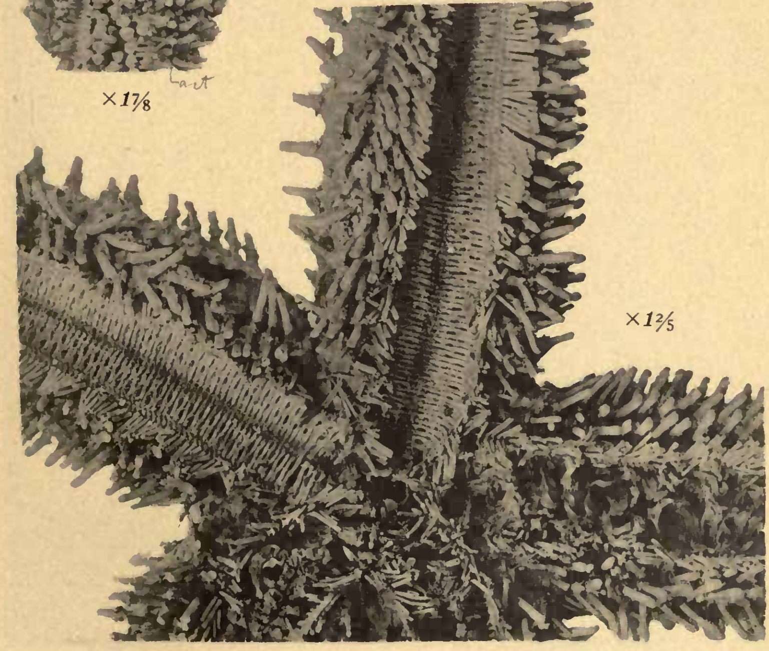
×1⅞

3



1/1

4



×1⅖

1, 2. Orthasterias columbiana Verrill. Type
3. Evasterias acanthostoma Verrill. Type
4. Orthasterias columbiana Verrill

25

25

PLATE XXV.

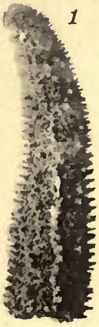
FIG. 1. *Evasterias troschelii.* Type of Stimpson. Part of a ray, dorsal side; about 9/10 natural size.

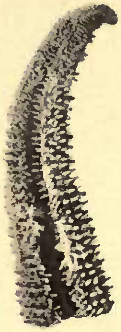
FIG. 2. The same specimen. Ventral side. U. S. Nat. Mus.

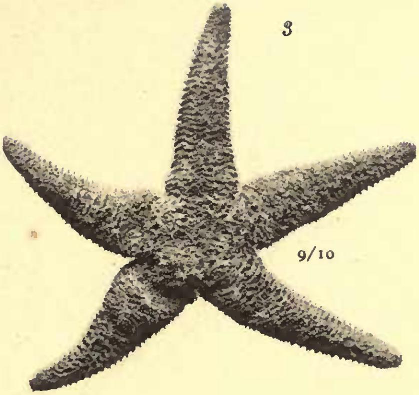
FIGS. 3, 4. *Ctenasterias cribraria* (Stimpson). Type of Stimpson. Dorsal and ventral sides; about 9/10 natural size.

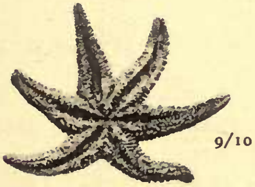
FIGS. 5, 6. *Leptasterias æqualis* (Stimpson). Type of Stimpson. Ventral side; about 9/10 natural size. U. S. Nat. Mus.

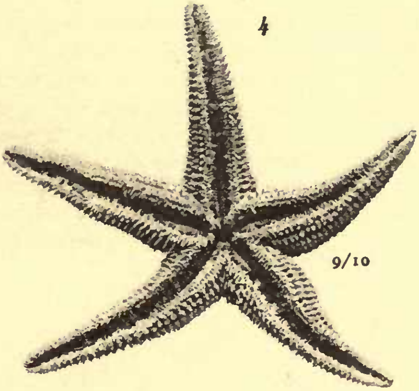
FIGS. 7, 8. *Leptasterias hexactis* (Stimpson). Type of Stimpson. Ventral side; about 9/10 natural size. U. S. Nat. Mus.

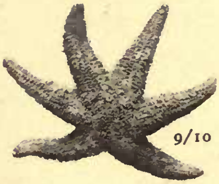


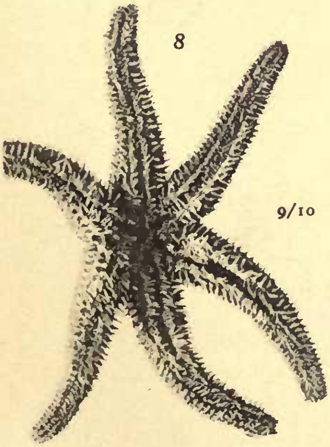


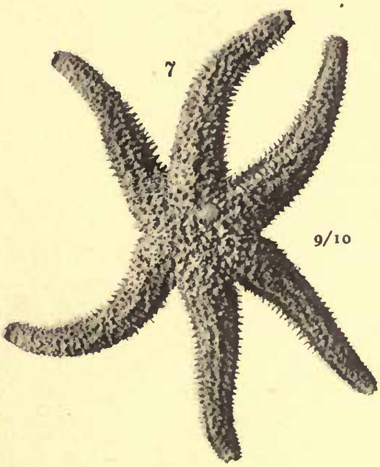












1, 2. Evasterias troschelii (Stimpson). Type of Stimpson
3, 4. Ctenasterias cribraria (Stimpson). Type of Stimpson
5, 6. Leptasterias æqualis (Stimpson). Type of Stimpson
7, 8. Leptasterias hexactis (Stimpson). Type of Stimpson

26

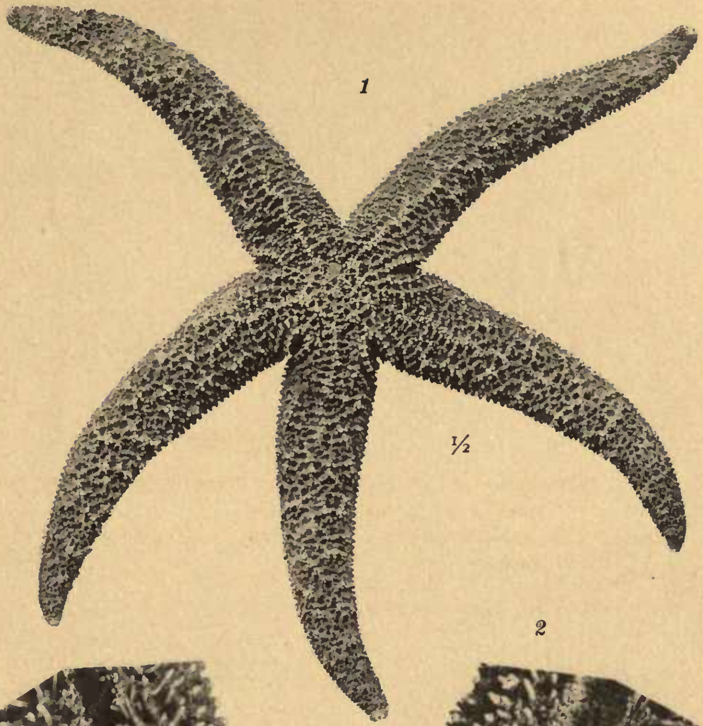
26

PLATE XXVI.

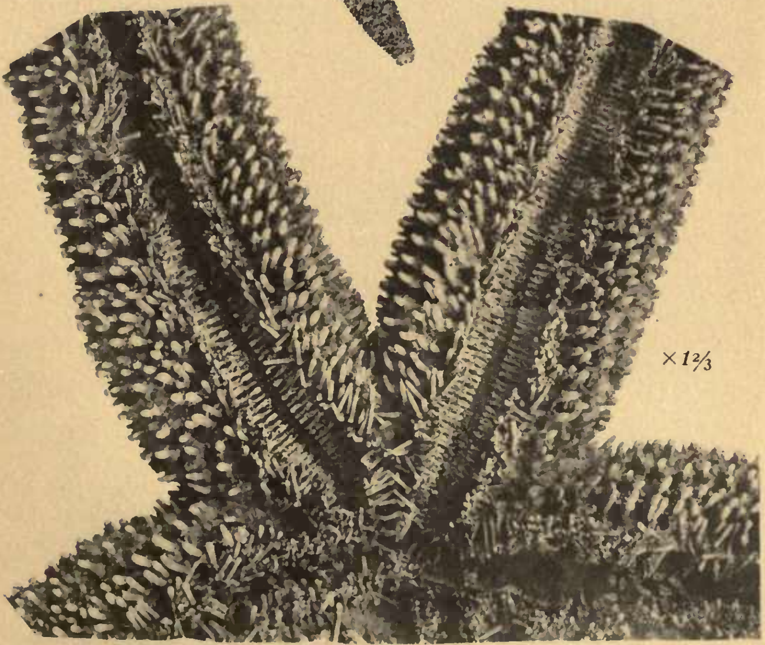
FIG. 1. *Evasterias troschelii* Stimpson. Typical form from Sitka. Dorsal side; about ½ natural size.

FIG. 2. The same specimen. Details of actinal side; × 1⅔. Yakutat. Yale Mus.

1



2



1. 2. Evasterias troschelii (Stimpson)

27.

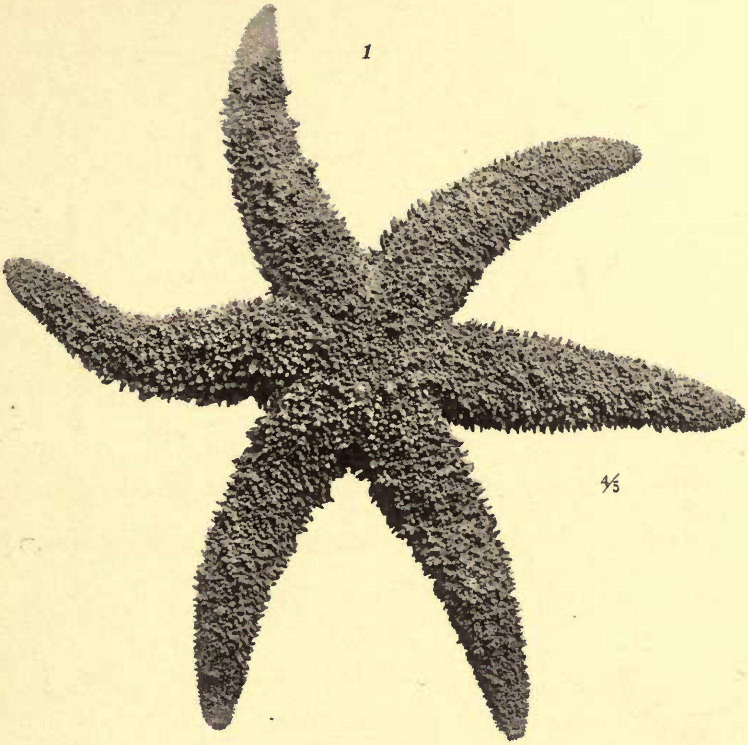
27

PLATE XXVII.

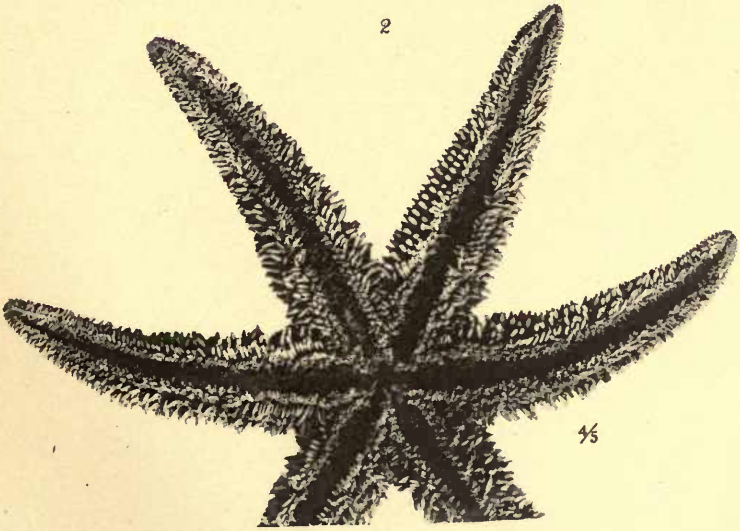
FIG. 1. *Asterias acervata* Stimpson. Type. Dorsal side; about ⅘ natural size. U. S. Nat. Mus.

FIG. 2. The same specimen. Ventral side; about ⅘ natural size.

1



2



1. Asterias acervata Stimpson. Type

28

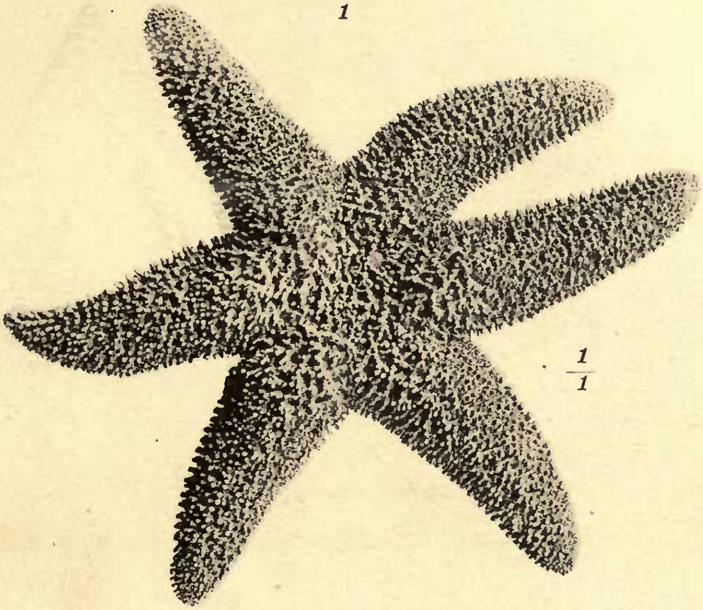
28.

PLATE XXVIII.

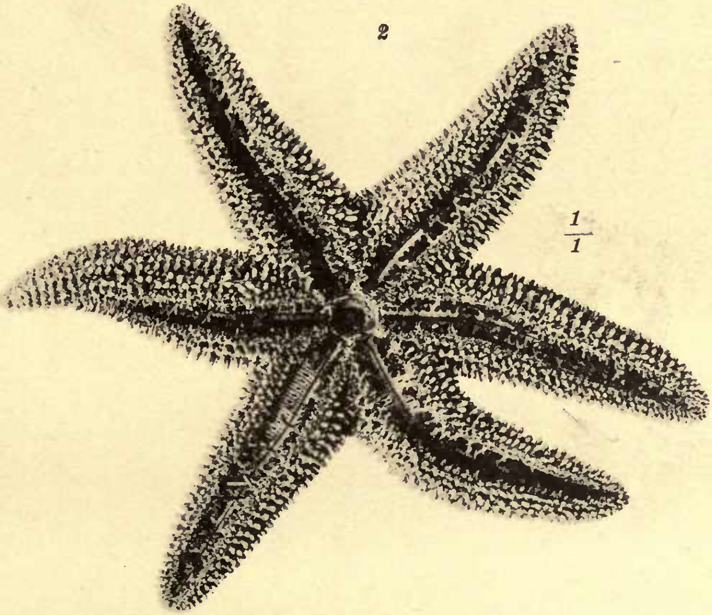
FIG. 1. *Leptasterias epichlora alaskensis* Verrill. Type. Dorsal side; natural size.

FIG. 2. The same specimen. Ventral side; natural size. Yale Mus.

1



2



1, 2. LEPTASTERIAS EPICHLORA ALASKENSIS Verrill. Type

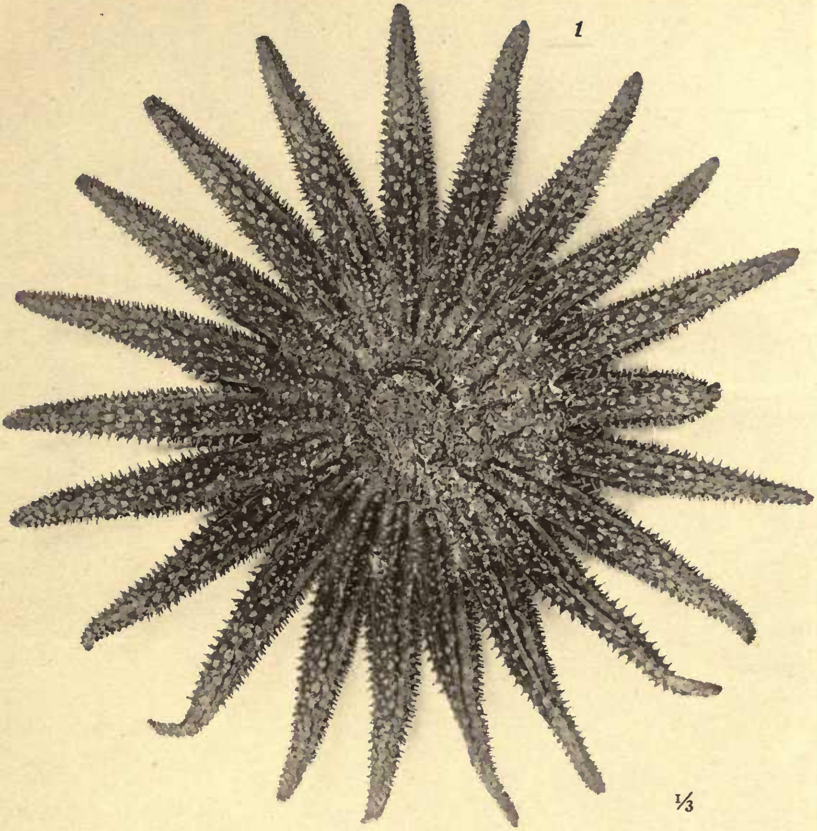
29

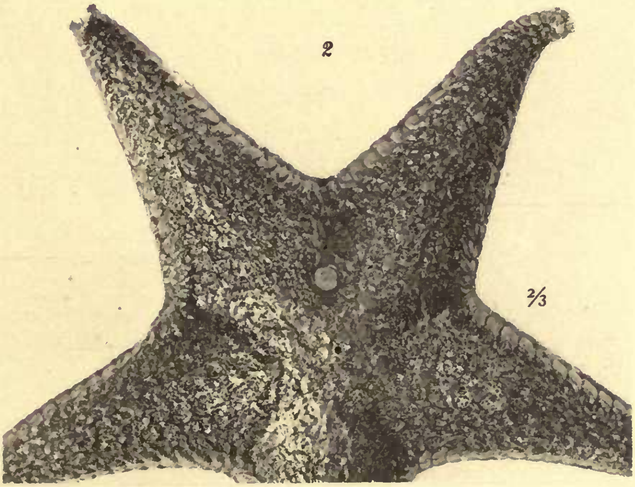
29

PLATE XXIX.

FIG. 1. *Pycnopodia helianthoides* (Brandt) Stimpson. Actinal side; about ⅓ natural size. Yale Mus.

FIG. 2. *Dermasterias imbricata* (Grube) Perrier. Dorsal side; ⅔ natural size. Yale Mus.





1. Pycnopodia helianthoides (Brandt)
2. Dermasterias imbricata (Grube)

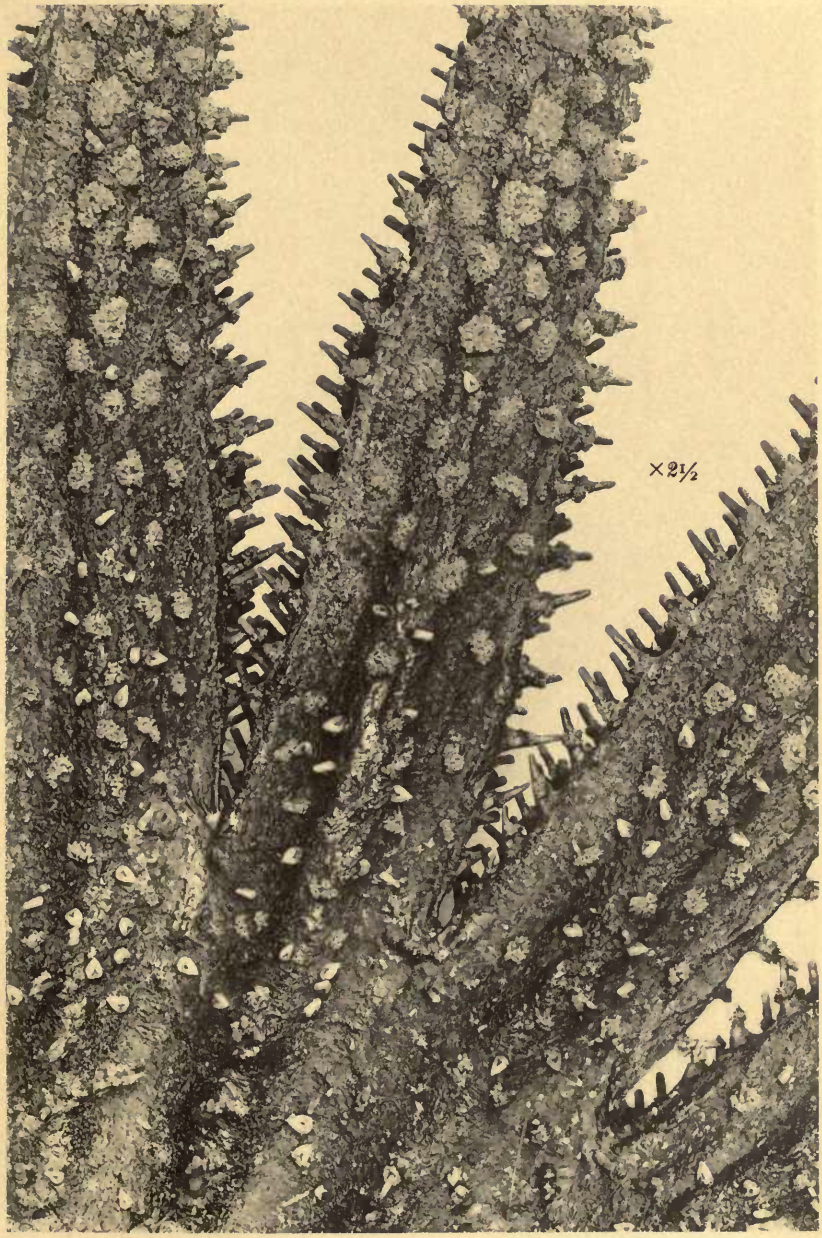
30

30

PLATE XXX.

FIG. 1. *Pycnopodia helianthoides* (Brandt) Stimpson. Same specimen as pl. XXIX, fig. 1. Details of dorsal side; × 2½.

30



PYCNOPODIA HELIANTHOIDES (Brandt)

31

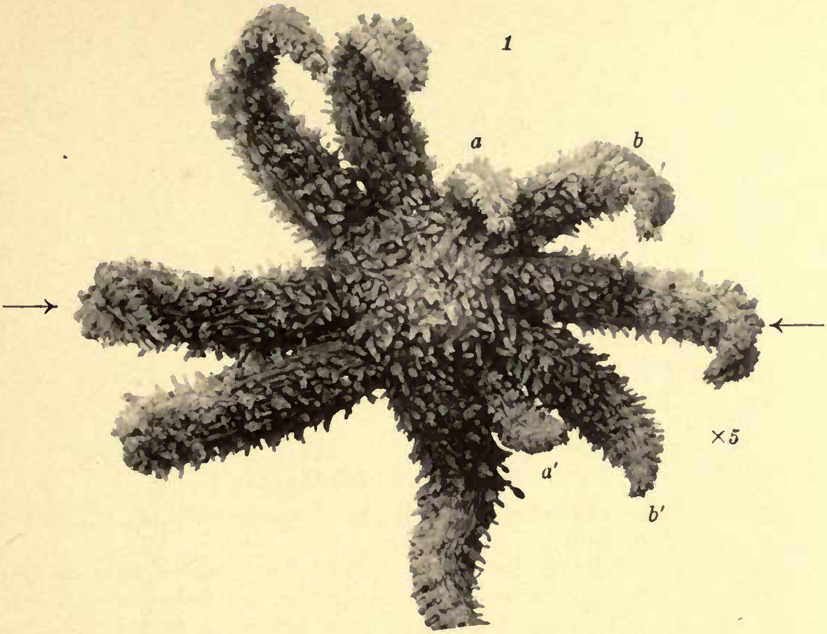
31

PLATE XXXI.

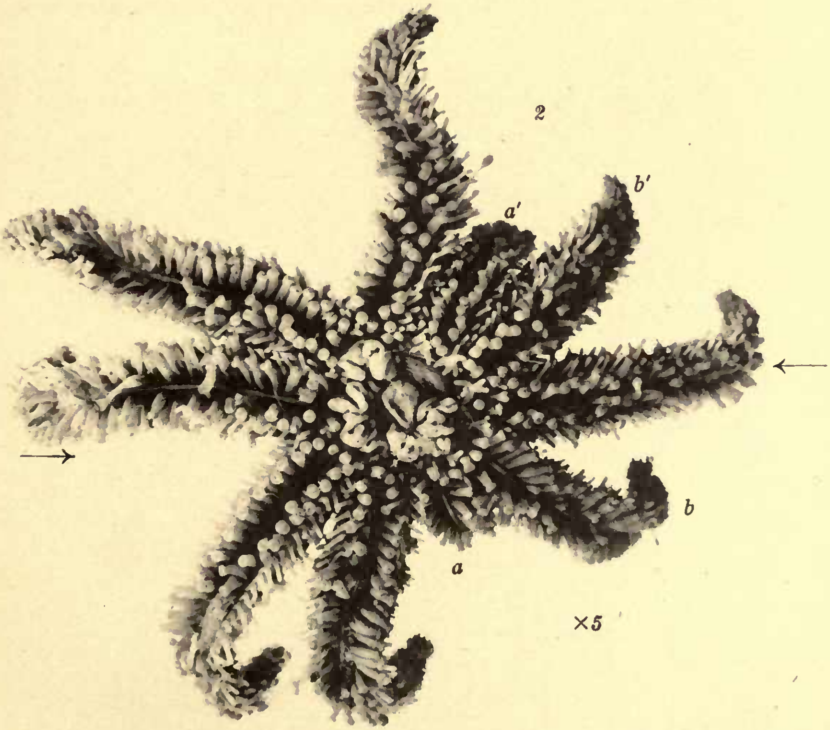
FIG. 1. *Pycnopodia helianthoides* (Brandt). Young, in alcohol. Dorsal side; × about 5.

FIG. 2. The same specimen. Actinal side. These figures show the interbudding of new rays, symmetrically to a median plane indicated by the arrows; *a, a'*, last-formed rays; *b, b'*, previous or first pair of interpolated rays, one on either side of a primary odd ray.

1



2



1, 2. Pycnopodia helianthoides (Brandt). Young, in alcohol

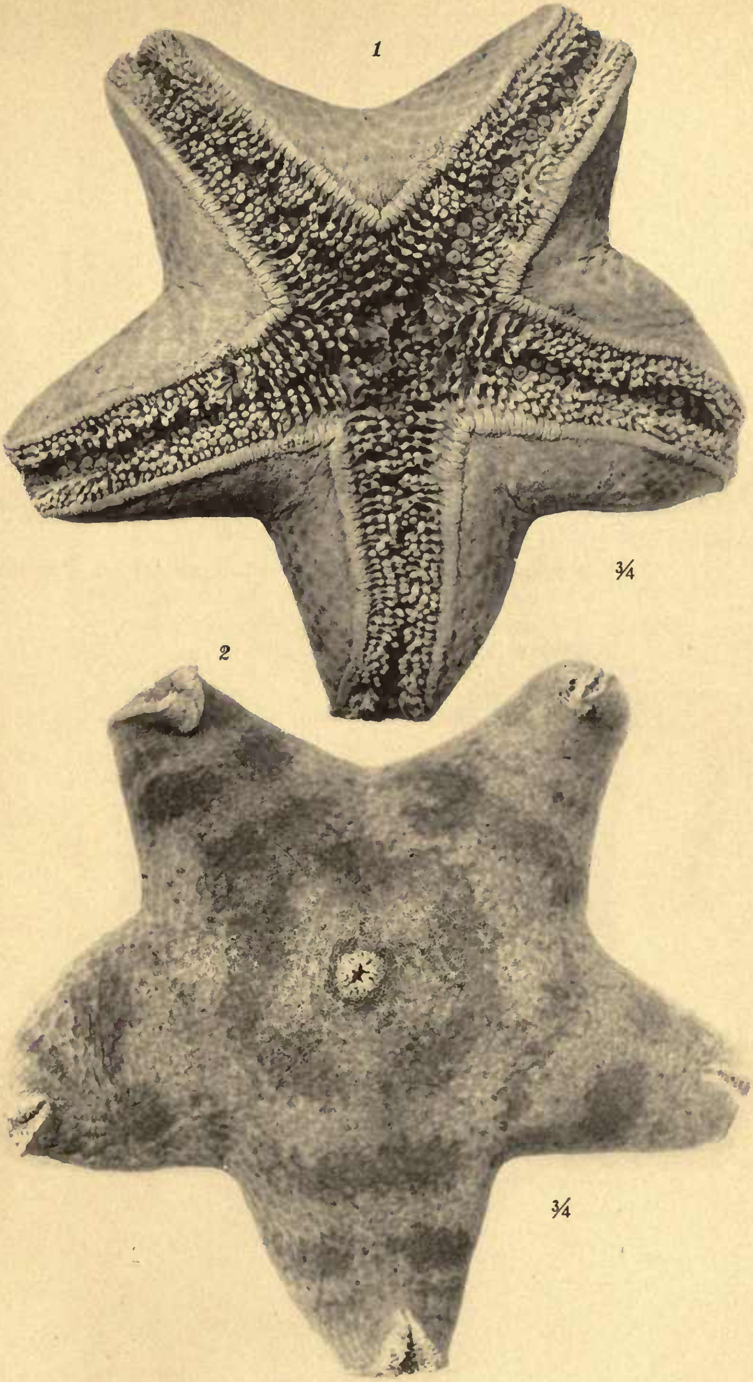
32

32

PLATE XXXII.

FIG. 1. *Pteraster tesselatus* Ives. Ventral side of an alcoholic specimen; about ¾ natural size.

FIG. 2. The same specimen. Dorsal side. Yale Mus.



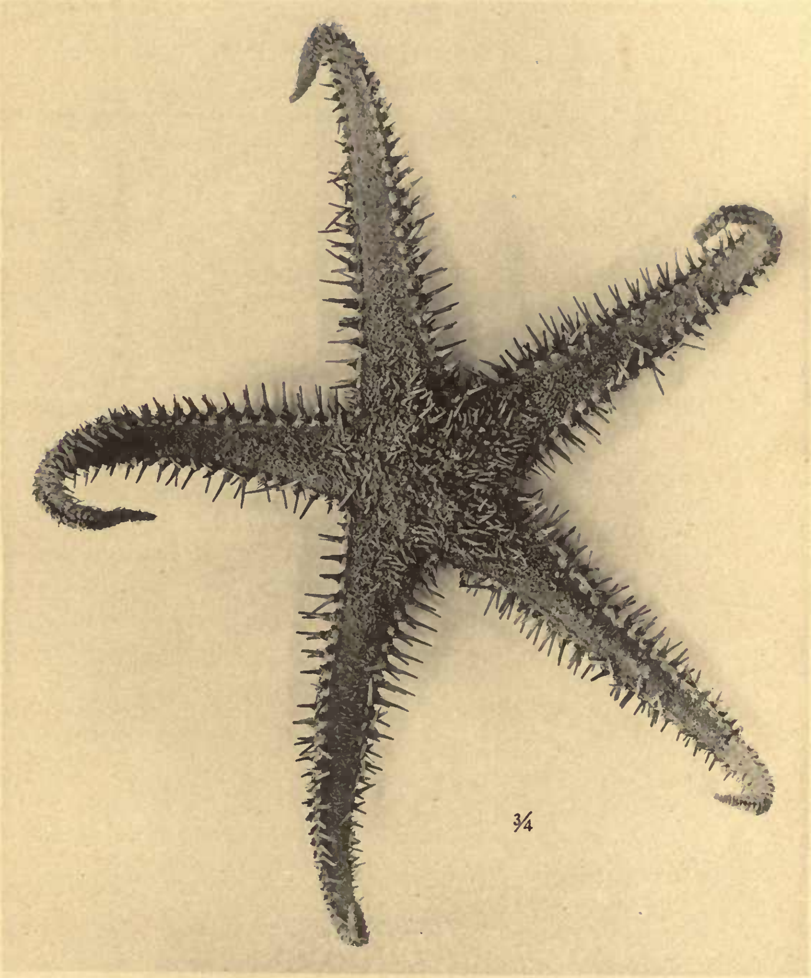
Pteraster tesselatus Ives

33

PLATE XXXIII.

FIG. 1. *Luidiaster dawsoni* (Verrill) Ludwig. Type. Dorsal side; about ¾ natural size. Canadian Geol. Survey.

33



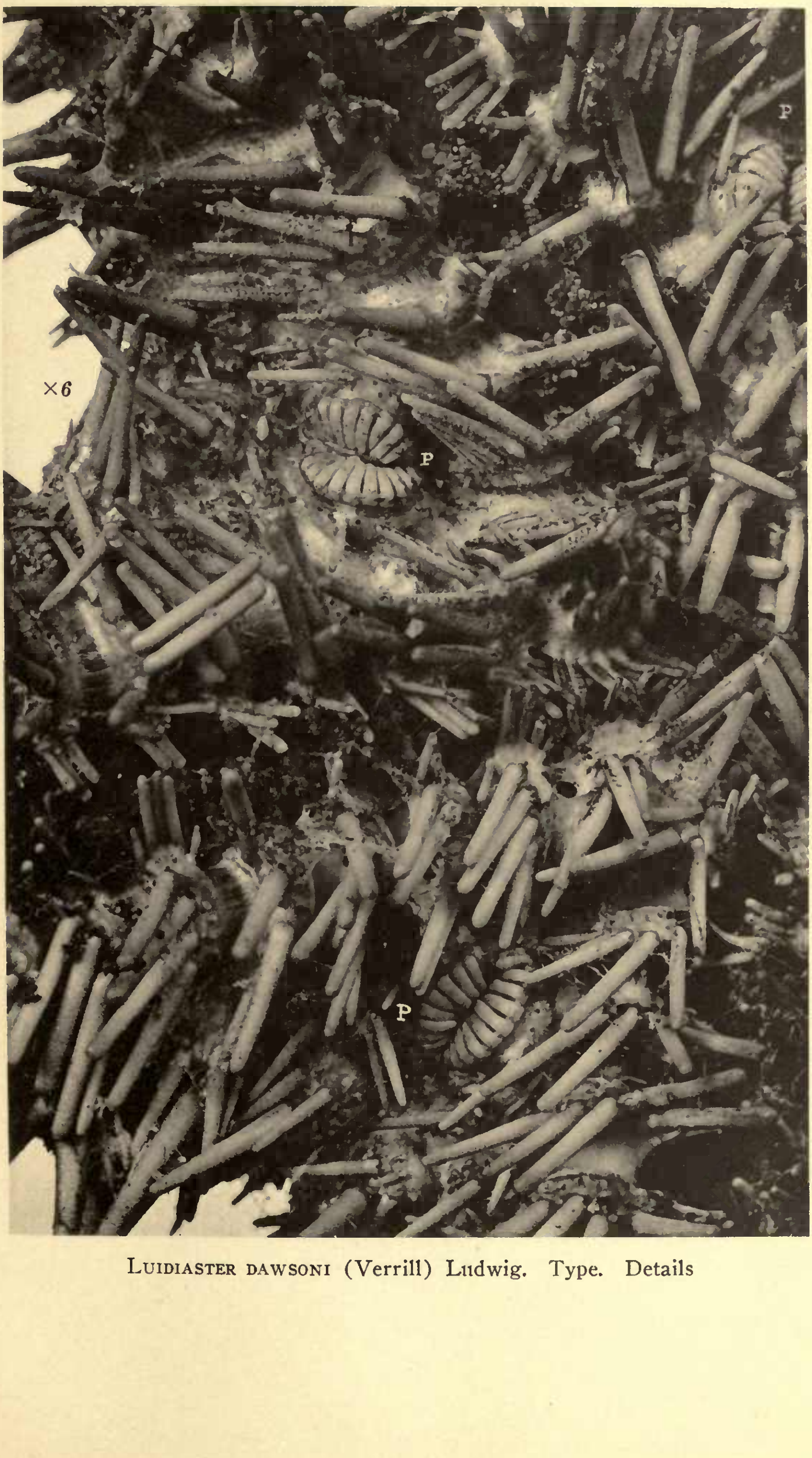
LUIDIASTER DAWSONI (Verrill) Ludwig. Type

34

34

PLATE XXXIV.

FIG. I. The same specimen as pl. XXXIII. Details of lower side of disk; *P, P, P,* pectinate or fasciolated pedicellariæ; × about 6.



Luidiaster dawsoni (Verrill) Ludwig. Type. Details

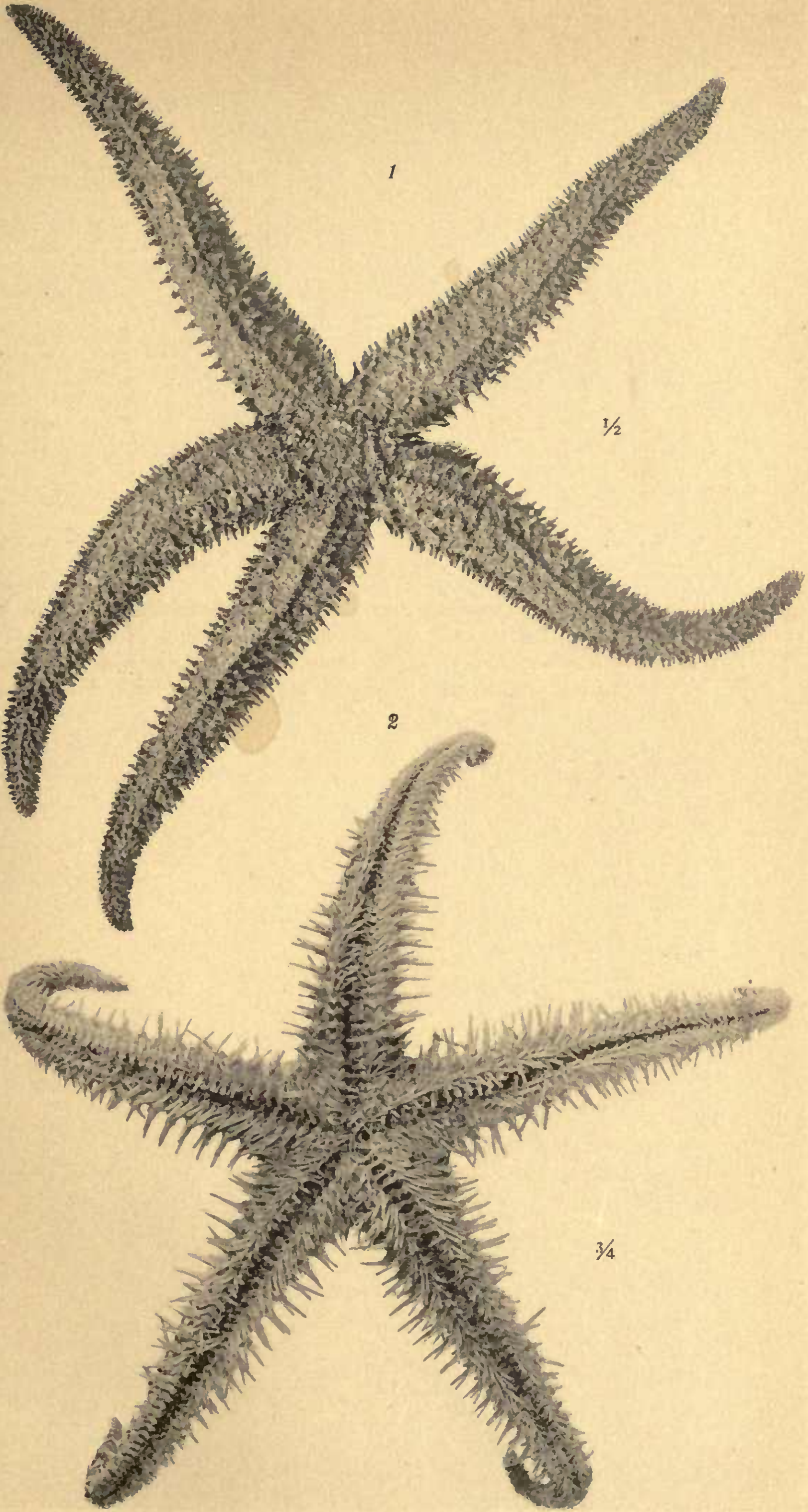
35—

35

PLATE XXXV.

FIG. 1. *Orthasterias columbiana* Verrill. Type. Same specimen as pl. XXIV, fig. 4. Dorsal side; ½ natural size. Yakutat. Yale Mus.

FIG. 2. *Luidiaster dawsoni* (Verrill) Ludwig. Type. Same specimen as pls. XXXIII and XXXIV. About ¾ natural size. Geol. Surv. Canada.



1. ORTHASTERIAS COLUMBIANA Verrill. Cotype
2. LUIDIASTER DAWSONI (Verrill) Ludwig. Type

36

36

PLATE XXXVI.

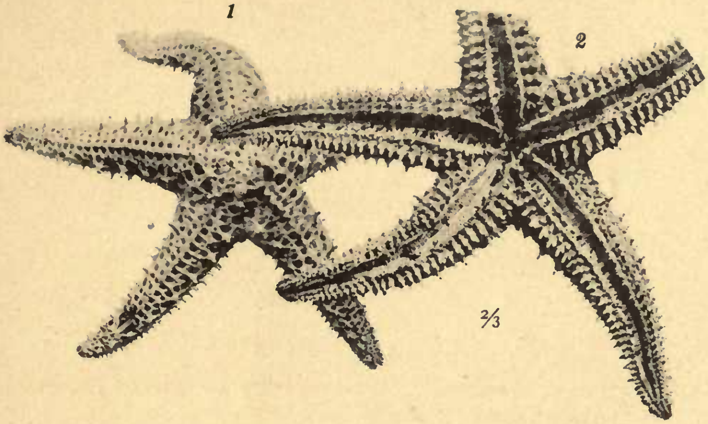
1280
uis Obispo
[illegible]

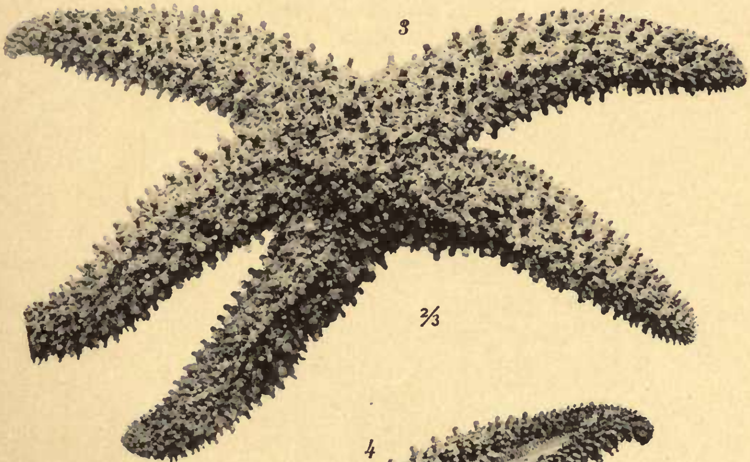
FIG. 1. *Pisaster paucispinus* (Stimpson) Verrill. Type of Stimpson. Dorsal view; about ⅔ natural size. No. 1287 USNM — Cotype

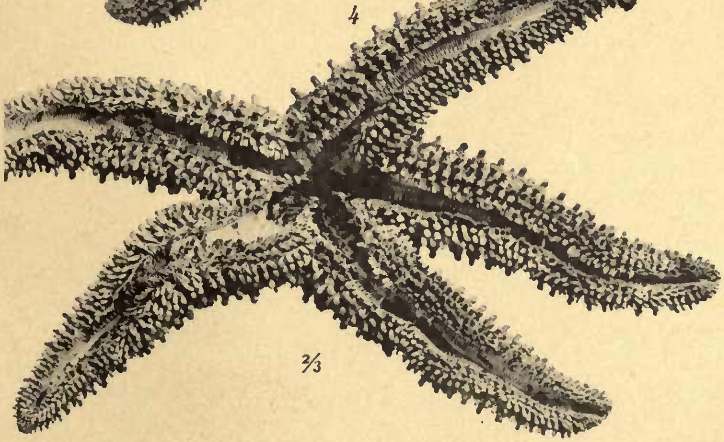
FIG. 2. The same. Actinal view; about ⅔ natural size. U. S. Nat. Mus. No 1286 Ty

FIG. 3. *Pisaster capitatus* (Stimpson) Verrill. Type of Stimpson. Dorsal view; ⅔ natural size.

FIG. 4. The same specimen. Actinal view; ⅔ natural size.







1, 2. Pisaster paucispinus (Stimpson) Verrill. Type of Stimpson
3, 4. Pisaster capitatus (Stimpson) Verrill. Type of Stimpson

37

37

PLATE XXXVII.

No 1283 USNM

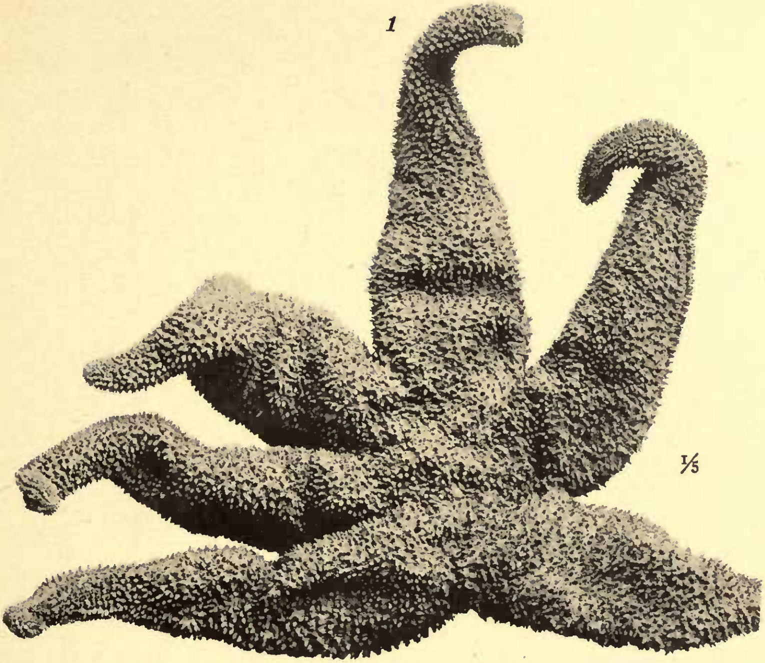
ales B. Cl.

Samuels

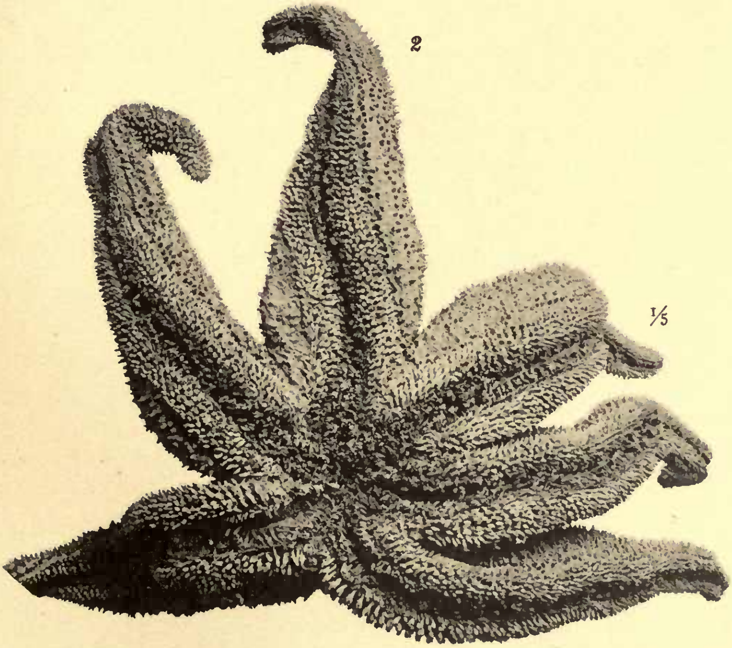
FIG. 1. *Pisaster giganteus* (Stimpson) Verrill. Type of Stimpson. Dorsal view; about ⅕ natural size.

FIG. 2. The same specimen. Actinal view. U. S. Nat. Mus.

1



2



1, 2. Pisaster giganteus (Stimpson) Verrill. Type of Stimpson

II

38

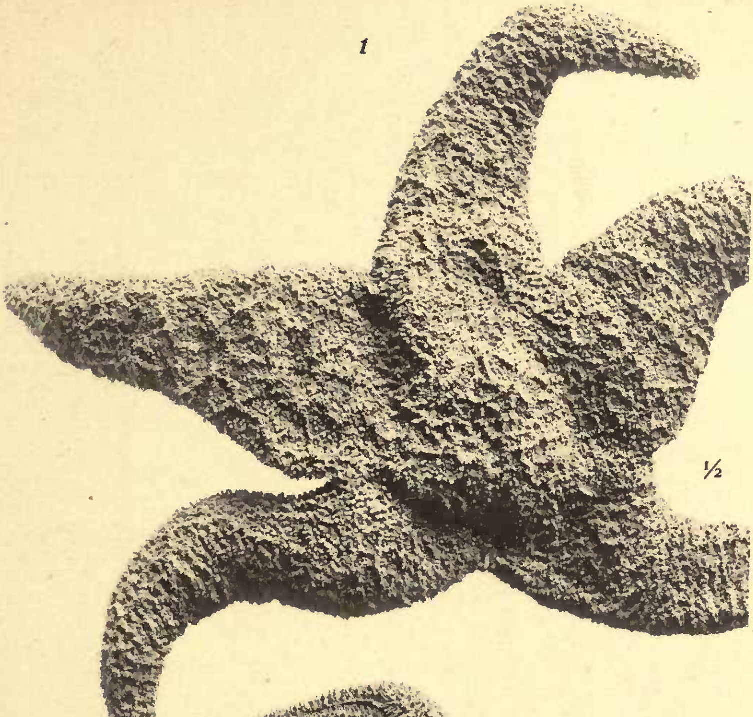
PLATE XXXVIII.

L no 1275 usnm

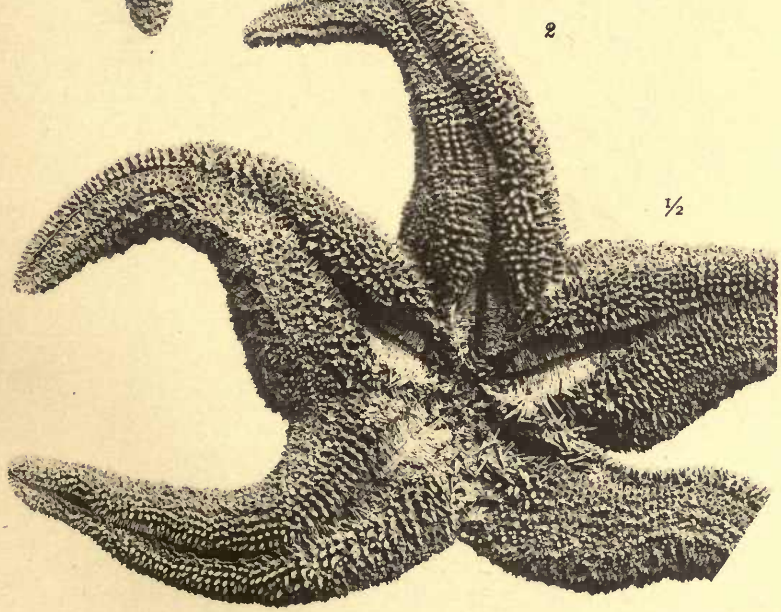
FIG. 1. *Pisaster confertus* (Stimpson) Verrill. Type. Dorsal view; about ½ natural size.

FIG. 2. The same specimen. Actinal view. U. S. Nat. Mus.

1



2



1, 2. Pisaster confertus (Stimpson) Verrill. Type

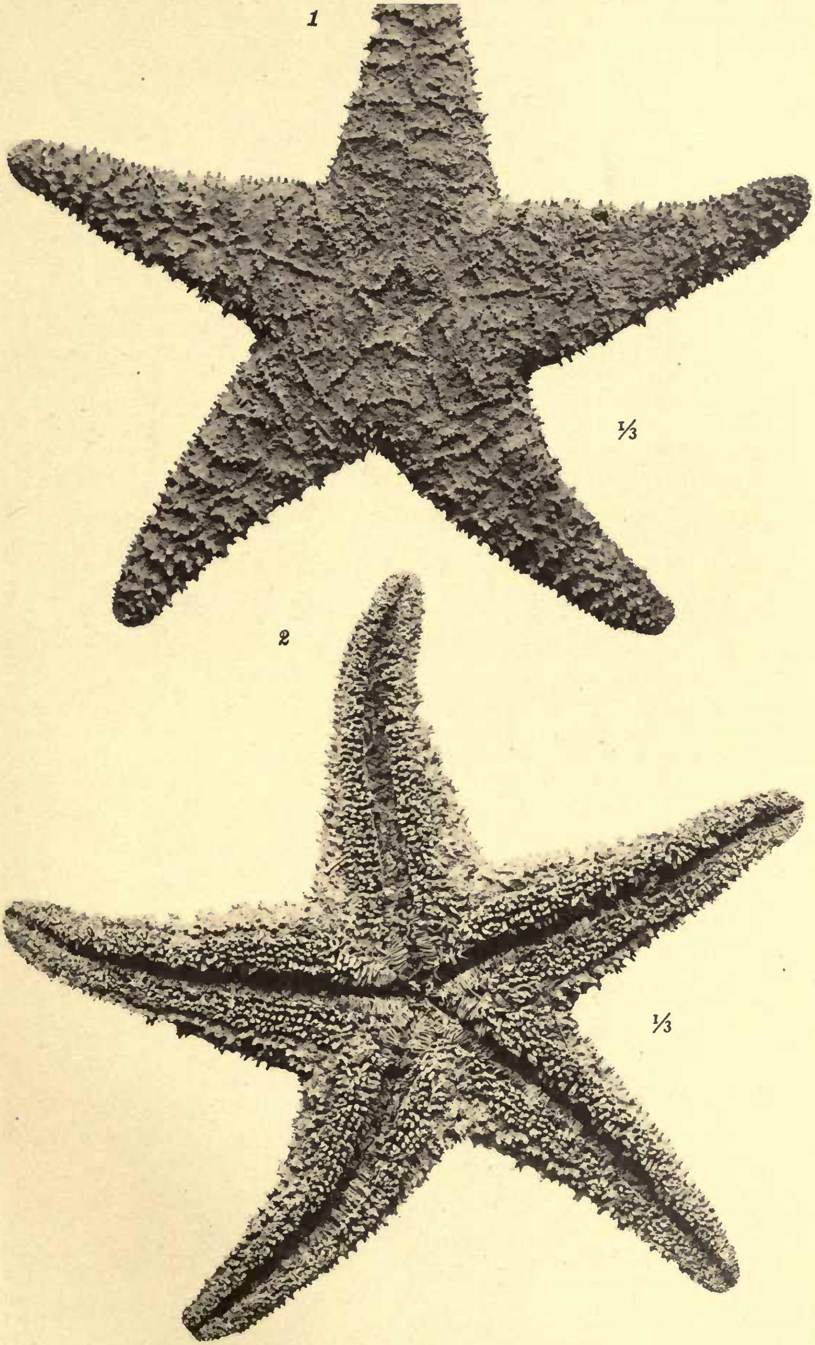
39

39

PLATE XXXIX.

FIG. 1. *Pisaster fissispinus* (Stimpson) Verrill. Type. Dorsal view; about ⅓ natural size.

FIG. 2. The same specimen. Actinal view. U. S. Nat. Mus.



I, 2. Pisaster fissispinus (Stimpson) Verrill. Type

40

40

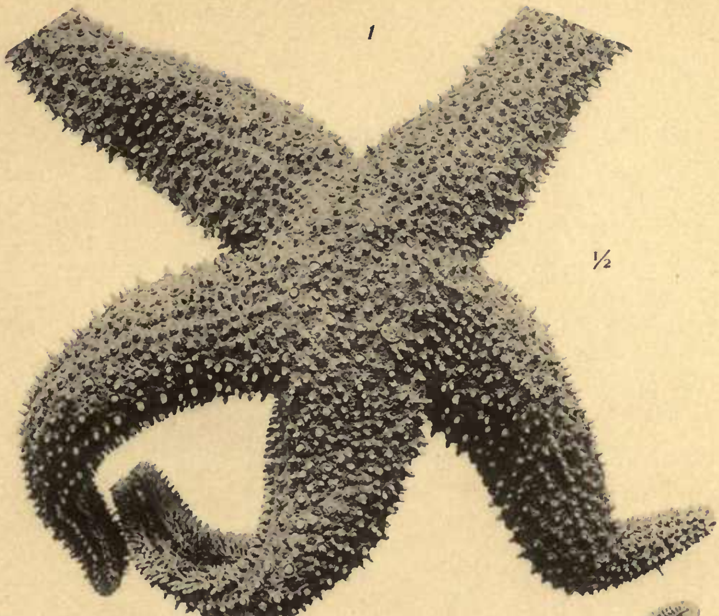
PLATE XL.

FIG. 1. *Pisaster lütkenii* (Stimpson) Verrill. Type. Dorsal view; about ½ natural size.

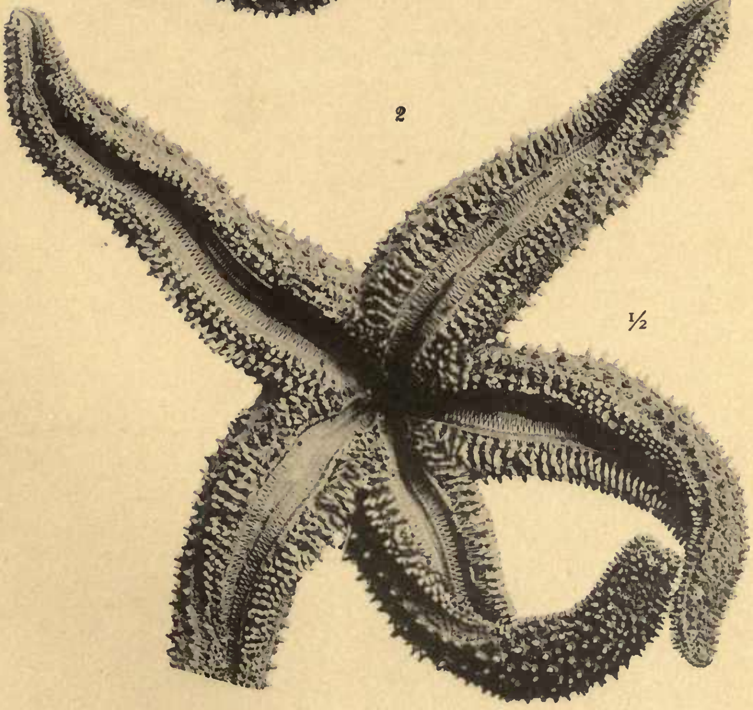
FIG. 2. The same specimen. Actinal view. U. S. Nat. Mus.

o/28 1
forma or Oregon"
mpson's original

1



2



I, 2. Pisaster lütkenii (Stimpson) Verrill. Type

41

1285

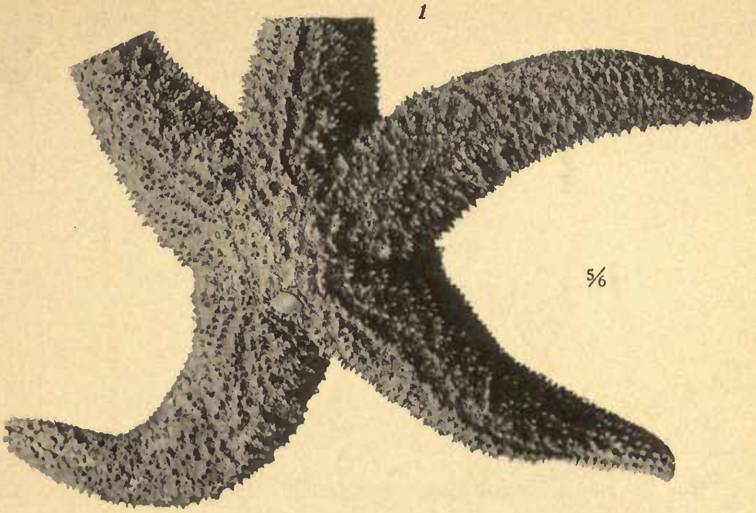
fornia (Sf -22)

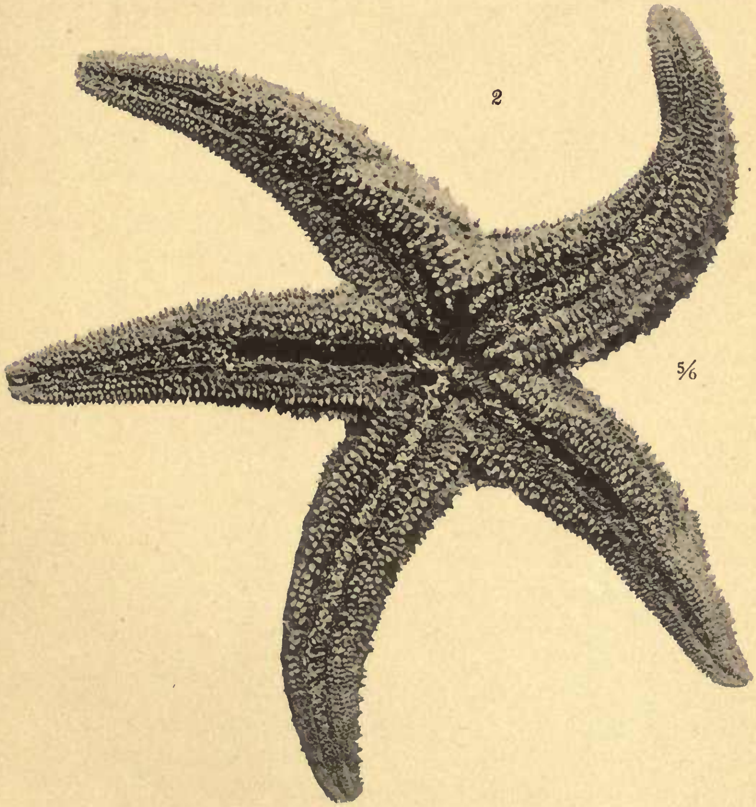
41

PLATE XLI.

FIG. 1. *Pisaster brevispinus* (Stimpson) Verrill. Type. Dorsal view; about ⅚ natural size. U. S. Nat. Mus.

FIG. 2. The same specimen. Actinal view; ⅚ natural size.





1, 2. Pisaster brevispinus (Stimpson) Verrill. Type

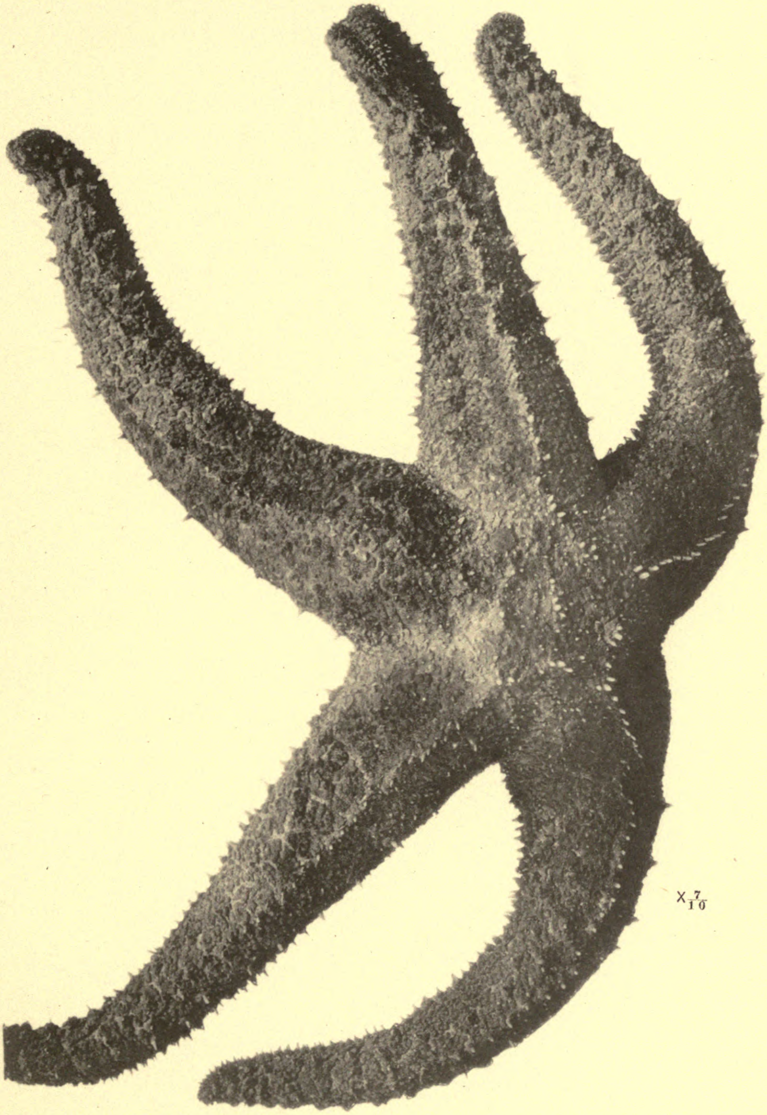
42

42

PLATE XLII.

Pisaster papulosus Verrill. Type. Dorsal view; about 7/10 natural size.

42



X $\frac{7}{10}$

HELIOTYPE CO., BOSTON

Pisaster papulosus Ver. Type

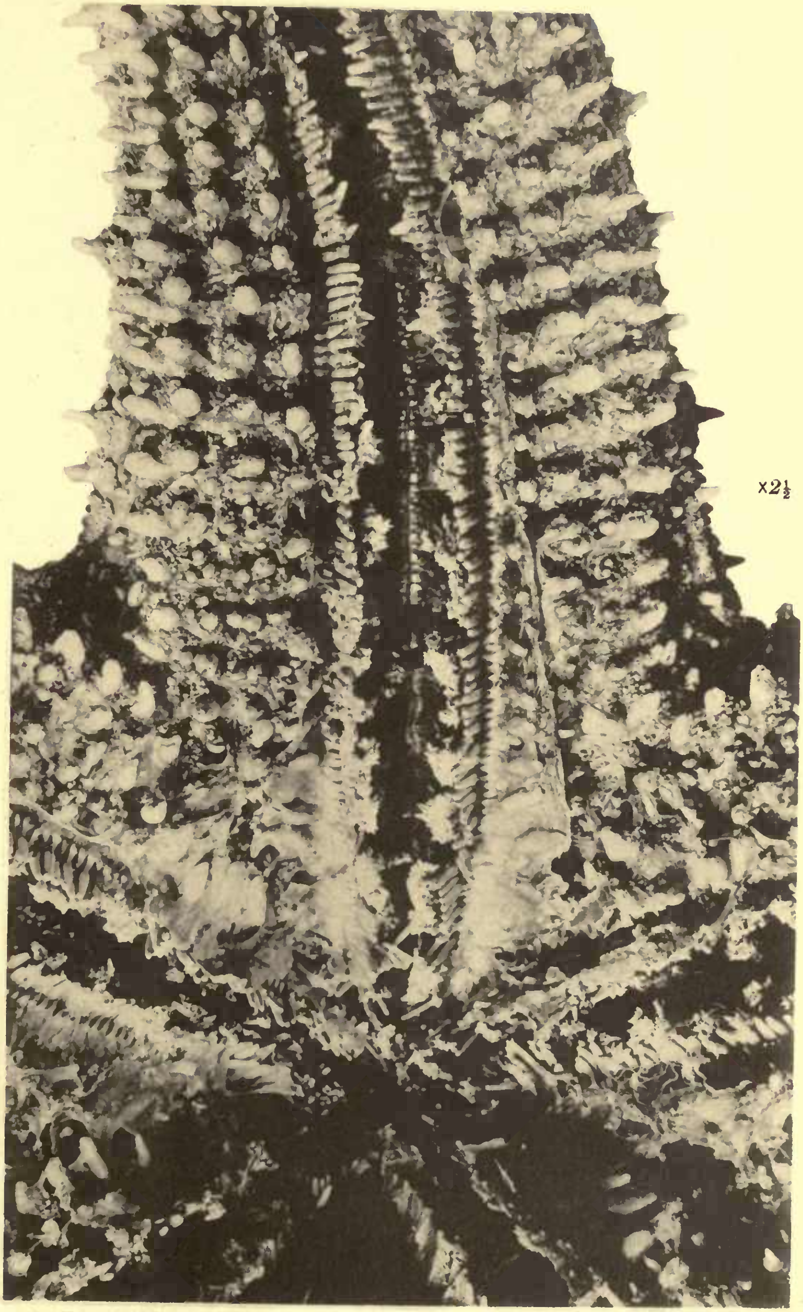
43

43

PLATE XLIII.

Pisaster papulosus Verrill. Actinal side of type; × 2½.

43



×2½

HELIOTYPE CO., BOSTON

Pisaster papulosus Ver. Type

44

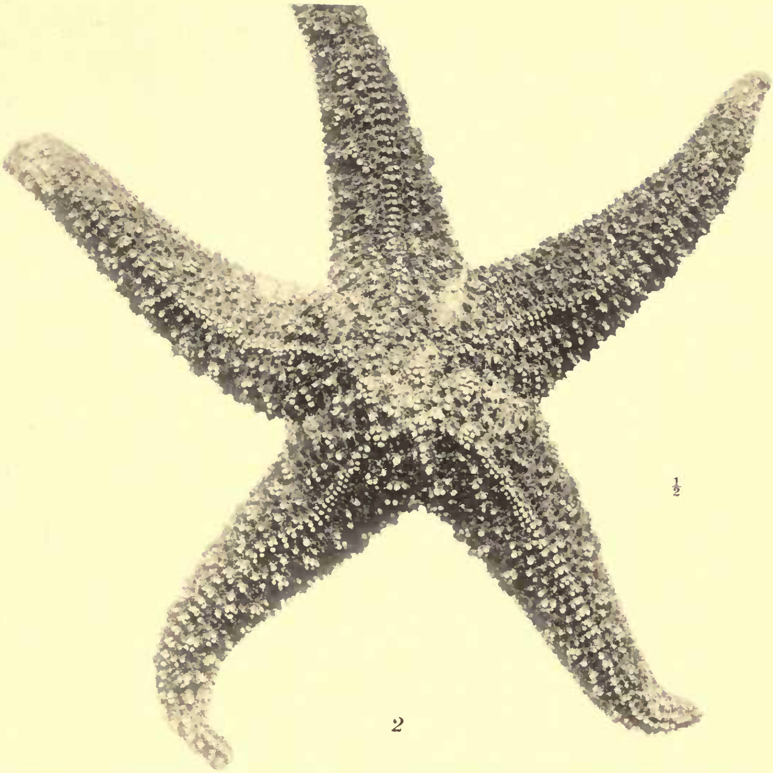
44

PLATE XLIV.

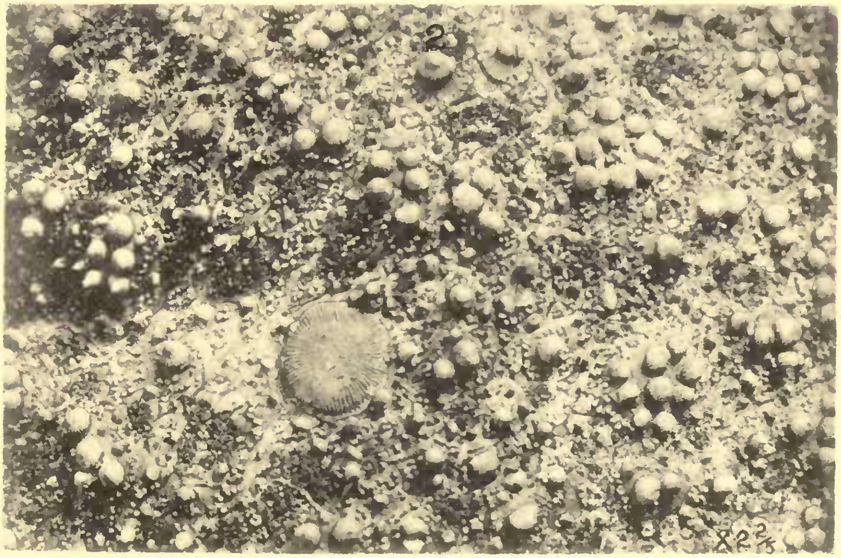
FIG. 1. *Pisaster brevispinus* (Stimpson) Verrill. Dorsal view; about ½ natural size. No. 1820, Mus. Comp. Zoöl.

FIG. 2. The same specimen. Dorsal view of a part of the disk, including the madreporic plate; × 2⅔.

1



2



HELIOTYPE CO., BOSTON

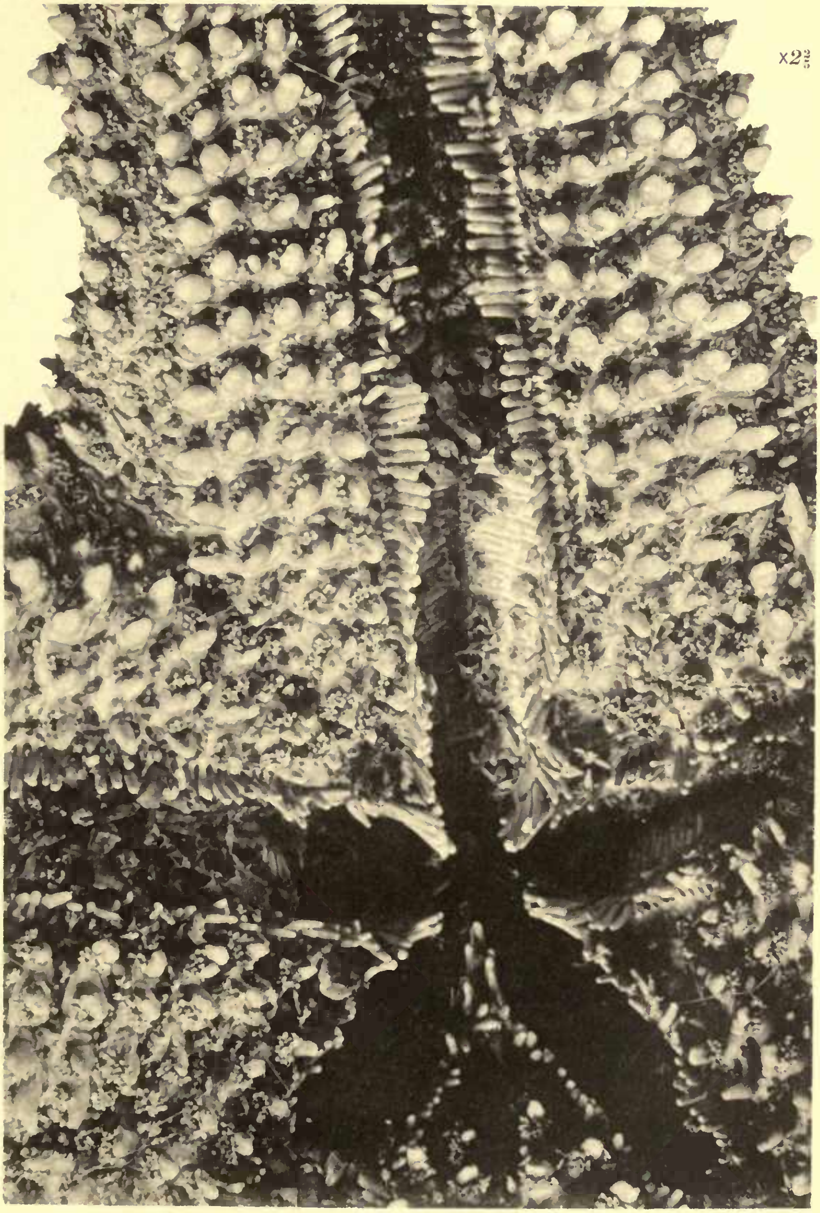
1.2. Pisaster brevispinus (St.) Ver.

45

45

PLATE XLV.

Pisaster brevispinus (Stimpson) Verrill. Actinal side; × 2⅗. No. 1820, Mus. Comp. Zoölogy.



HELIOTYPE CO., BOSTON

Pisaster brevispinus (St.) Ver.

46

46

PLATE XLVI.

FIG. 1. *Solaster stimpsoni* Verrill. Profile view of adambulacral, marginal, and adjacent spines; *a, a,* adambulacral spines, actinal series; *a′, a′,* furrow series; *b,* peractinals; *m, m,* inferomarginals; *m′,* supramarginals; *d,* dorso-lateral spines and plates.

FIG. 1*a*. The same specimen. A group of dorsal pseudopaxillæ and papular pores; × about 9.

FIG. 1*b*. The same specimen. Dorsal pseudopaxillæ from base of ray, vertical and side views; × 17.

FIG. 1*c*. The same specimen. A dorsal, dermal, bivalve pedicellaria from near the edge of a papular pore; × 150.

FIG. 2. *Solaster galaxides* Verrill. Type. Profile view of actinal side; *a, a,* plates; × about 7. Lettering as in fig. 1.

FIG. 2*a*. The same. A group of dorsal pseudopaxillæ from another specimen; × about 17. No. 1897, Mus. Comp. Zoöl.

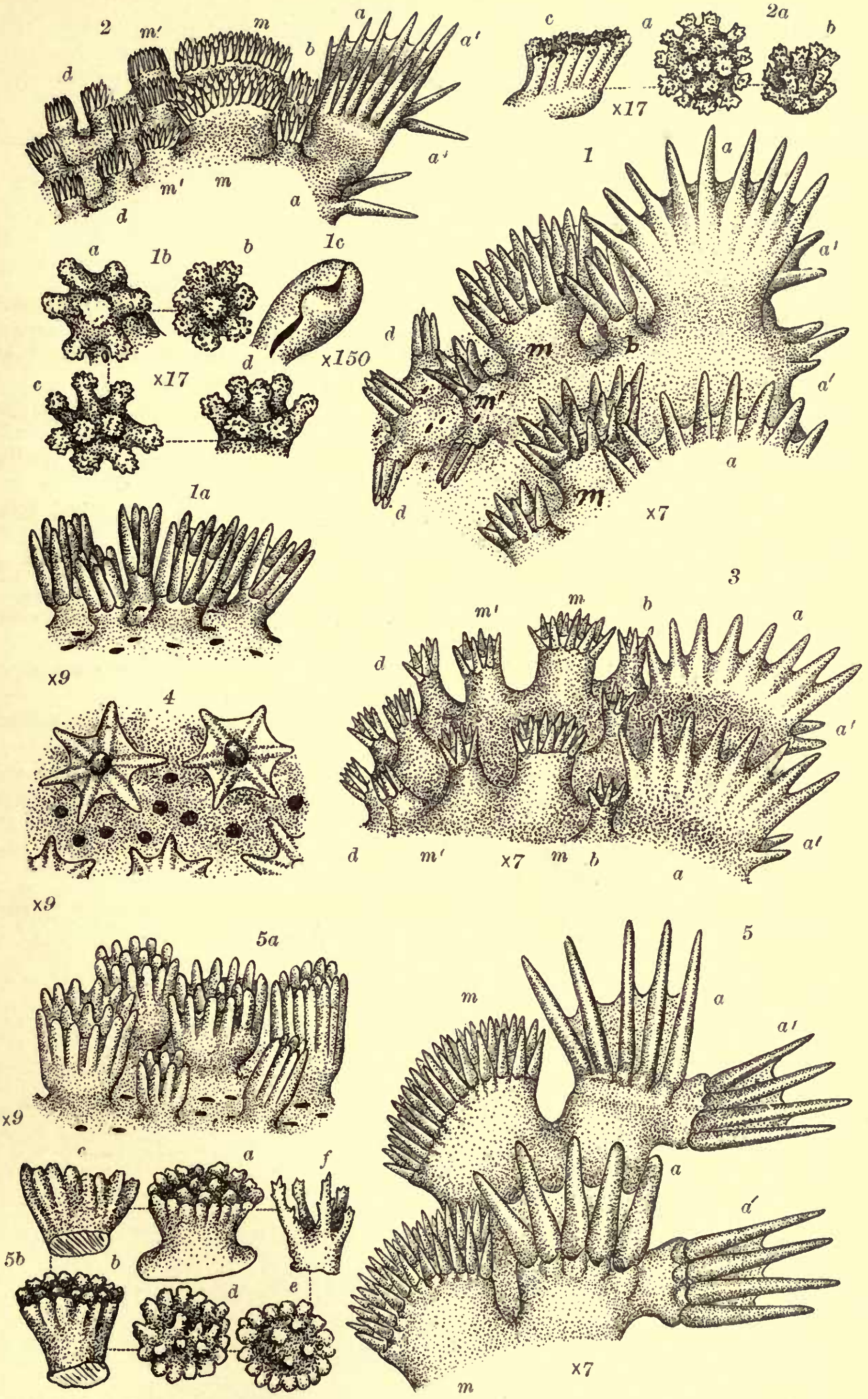
FIG. 3. *Solaster constellatus* Verrill. Type. × about 7. Lettering as in fig. 1.

FIG. 4. The same specimen. A group of dorsal pseudopaxillæ and papular pores, seen from above; × about 9.

FIG. 5. *Solaster dawsoni* Verrill. Type. Profile view of adambulacral and inferomarginal plates and spines from middle part of a ray. Lettering as in fig. 1.

FIG. 5*a*. The same specimen. A group of dorsal pseudopaxillæ and papular pores; × 9.

FIG. 5*b*. The same. Dorsal pseudopaxillæ from the type specimen, vertical and side views; × 17.



A. HYATT VERRILL DEL.

HELIOTYPE CO., BOSTON

1-1c. Solaster stimpsoni Ver. Details
2.2a. S. galaxides Ver. Details. Type
3.4. S. constellatus Ver. Details. Type
5-5b. S. dawsoni Ver. Details

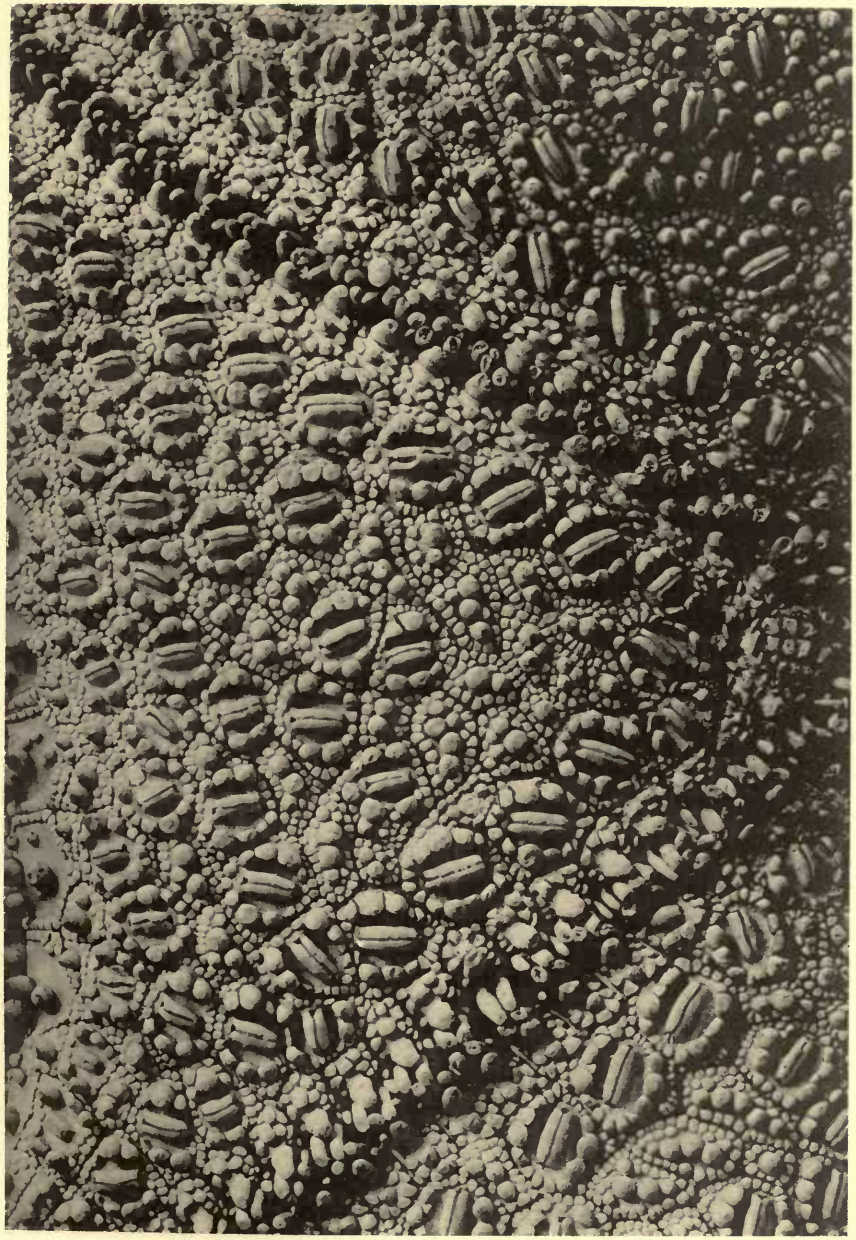
47

47

PLATE XLVII.

FIG. 1. *Hippasteria phrygiana* (Parel.) Agassiz. Photograph of under side of an Atlantic specimen; enlarged.

47



Hippasteria phrygiana (Parel.) Agassiz photograph of under side of an Atlantic specimen enlarged

48

PLATE XLVIII.

FIG. 1. *Hippasteria phrygiana* (Parel.) Agassiz. Part of the dorsal surface of a New England specimen (314); × 6.

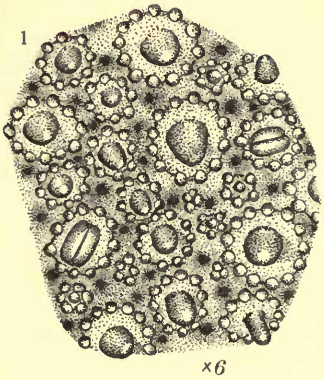
FIG. 2. The same. One of the jaws and adoral plates; *a, a'*, first and second adambulacral plates; *ep*, epioral spines; *pr*, apical peroral spines; *o*, large valvular pedicellaria on first actinal interradial plate; × 6.

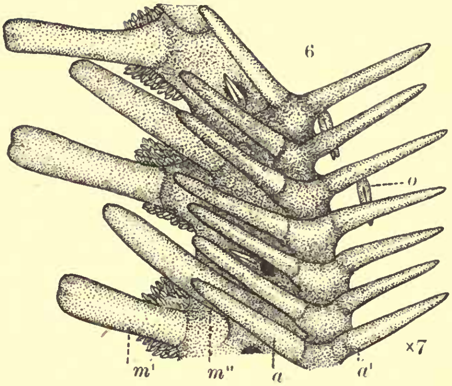
FIG. 3. The same. Two inferomarginal plates (*m''*) and adjacent interactinals; × 6.

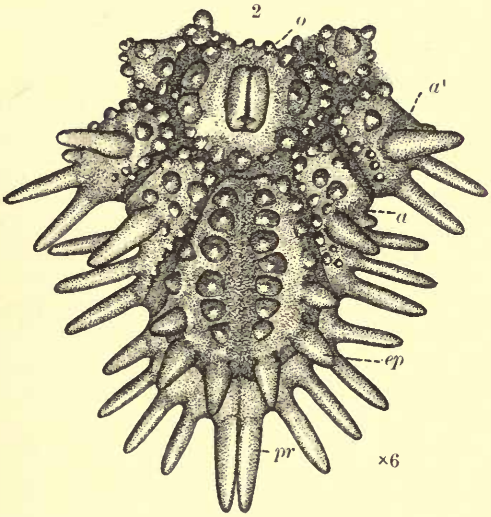
FIG. 4. The same. Central part of disk, showing dorsal "anal" or nephridial pore; × 6.

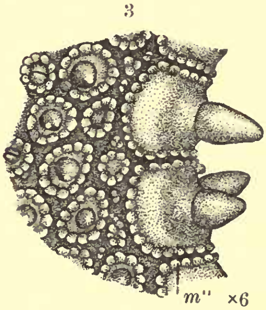
FIG. 5. The same. Three adambulacral plates and spines (*a*) and adjacent interactinal plates, each bearing a large valvular pedicellaria; × 6.

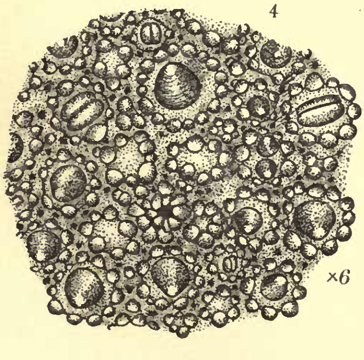
FIG. 6. *Orthasterias tanneri* Verrill. *a*, outer, and *a'*, inner adambulacral spines; *m'*, supramarginals, and *m''*, inferomarginals; *o*, one of the large, acute major pedicellariæ; × 7. From off the Atlantic coast. No. 5524. Yale Mus.

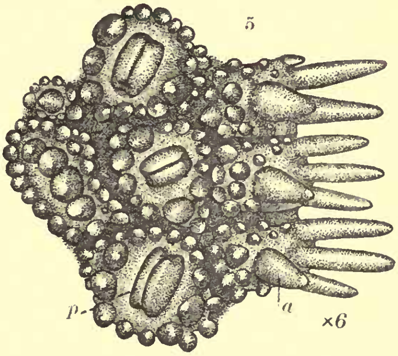












A. H. VERRILL, FROM NATURE. HELIOTYPE CO.

1-5. HIPPASTERIA PHRYGIANA (Parel.) Agassiz
6. ORTHASTERIAS TANNERI Verrill

49

PLATE XLIX.

FIG. 1. *Henricia sanguinolenta,* var. *pectinata* Verrill. Type. From an Atlantic specimen. Part of the dorsal surface; × 14.

FIG. 1*a*. The same specimen. Part of under surface and side of a ray; *a,* adambulacral spines; *a′,* inner or groove-spine; *p, p,* peractinal row of pseudopaxillæ; *m′, m′,* supramarginals; *m″, m″,* inferomarginals; *b, b,* papulæ; × 14.

FIG. 1*b*. The same. Profile view of one interambulacral and one peractinal group of spines; × 14.

FIG. 2. *Henricia sanguinolenta* (Müll.) Bell. Young. Atlantic specimen. Altered from Duncan and Sladen, × 5.

FIGS. 3–3*e*. Major or forficulate pedicellariæ of *Pisaster ochraceus,* much enlarged; 3, profile view of one of the larger erect, unguiculate, lateral kind; 3*a*, 3*b*, interior surface of valves; 3*c*, 3*d*, two of the smaller forms; 3*e*, a small group of the small pedicellate forms found on the margin of the adambulacral plates.

t ochraceus
-77 = brevisp

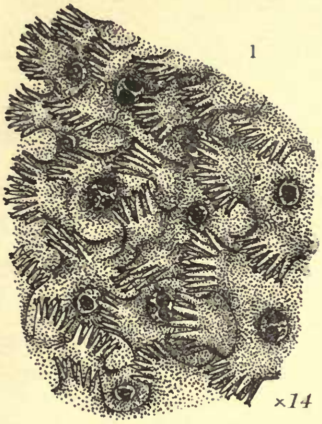
FIG. 4. *Crossaster papposus* (Linn.) M. & Tr. Part of the skeleton of a ray, of an Arctic specimen, after Danielssen and Koren; *a, a,* adambulacral plates; *m′, m′,* superomarginals; *m″, m″,* inferomarginals; *c,* connective ossicle; *d,* dorsal plates and pseudopaxillæ; enlarged.

FIG. 5. *Ctenodiscus crispatus* (Retz.) D. & Kor. From an Atlantic specimen, after Müller and Troschel. Under side of base of a ray.

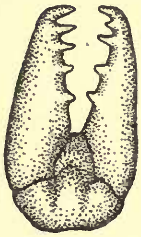
FIG. 5*a*. The same. Part of the dorsal surface. × about 2.

FIG. 6. *Hippasteria phrygiana.* Part of disk, showing madreporic plate; × 8.

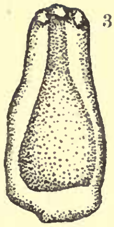
1



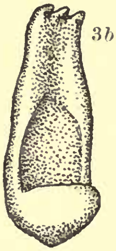
3



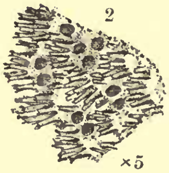
3a



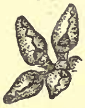
3b



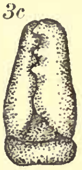
2



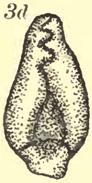
3e



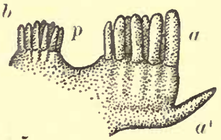
3c



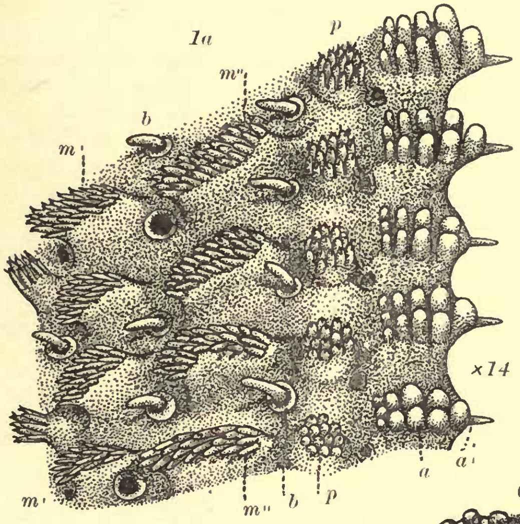
3d



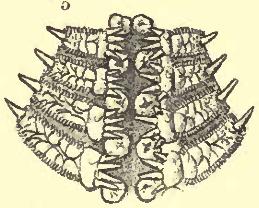
1b



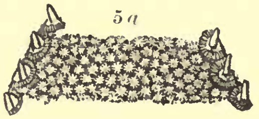
1a



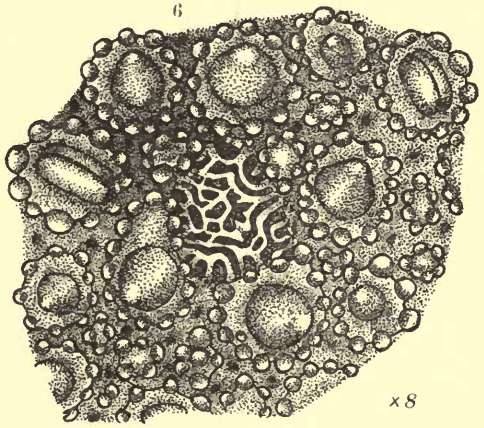
5



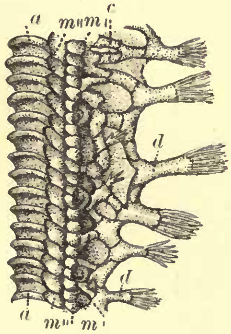
5a



6



4



A. H. VERRILL, FROM NATURE. HELIOTYPE CO.

1-1*a*. Henricia sanguinolenta, var. pectinata Verrill
2. Henricia sanguinolenta (Müll.) Bell
3-3*e*. Pisaster ochraceus (Brandt)
4. Crossaster papposus (Linn.) M. & Tr.
5-5*a*. Ctenodiscus crispatus (Retz.) D. & Kor.

50

PLATE L.

FIG. 1. *Dermasterias imbricata* (Grube) Perrier. *a, c,* pedicellariæ, mostly bivalved, from actinal side; × 26.

FIG. 1*a*. The same specimen. *a-c,* bivalved and trivalved pedicellariæ from the actinal side; × 26.

FIG. 1*b*. The same specimen. *a-f,* four-valved and five-valved pedicellariæ from the dorsal side; × 26.

FIG. 2. *Ceramaster granularis* (Retz.) Verrill. Plates of the dorsal side covered with granules; the central one bears a bivalved pedicellaria; × 8.

FIG. 2*a*. The same specimen, with the granules removed from two of the plates; × 8.

FIG. 3. *Tosiaster arcticus* Verrill. Type. A group of dorsal plates, partially in profile; some of them (*c, c*) with the large granules removed; also showing papular pores; × 8.

FIG. 3*a*. The same specimen. A group of dorsal plates, some of them (*c, c*) with the granules removed; *p,* bivalved pedicellariæ; × 8.

FIG. 4. *Hippasteria spinosa* Verrill. Type. *a', a'* inner, and *a,* outer adambulacral spines; *p, p',* pedicellariæ of actinal plates; × 8.

FIG. 4*a*. The same specimen. A group of dorsal plates and spines; *p, p,* pedicellariæ; × 8.

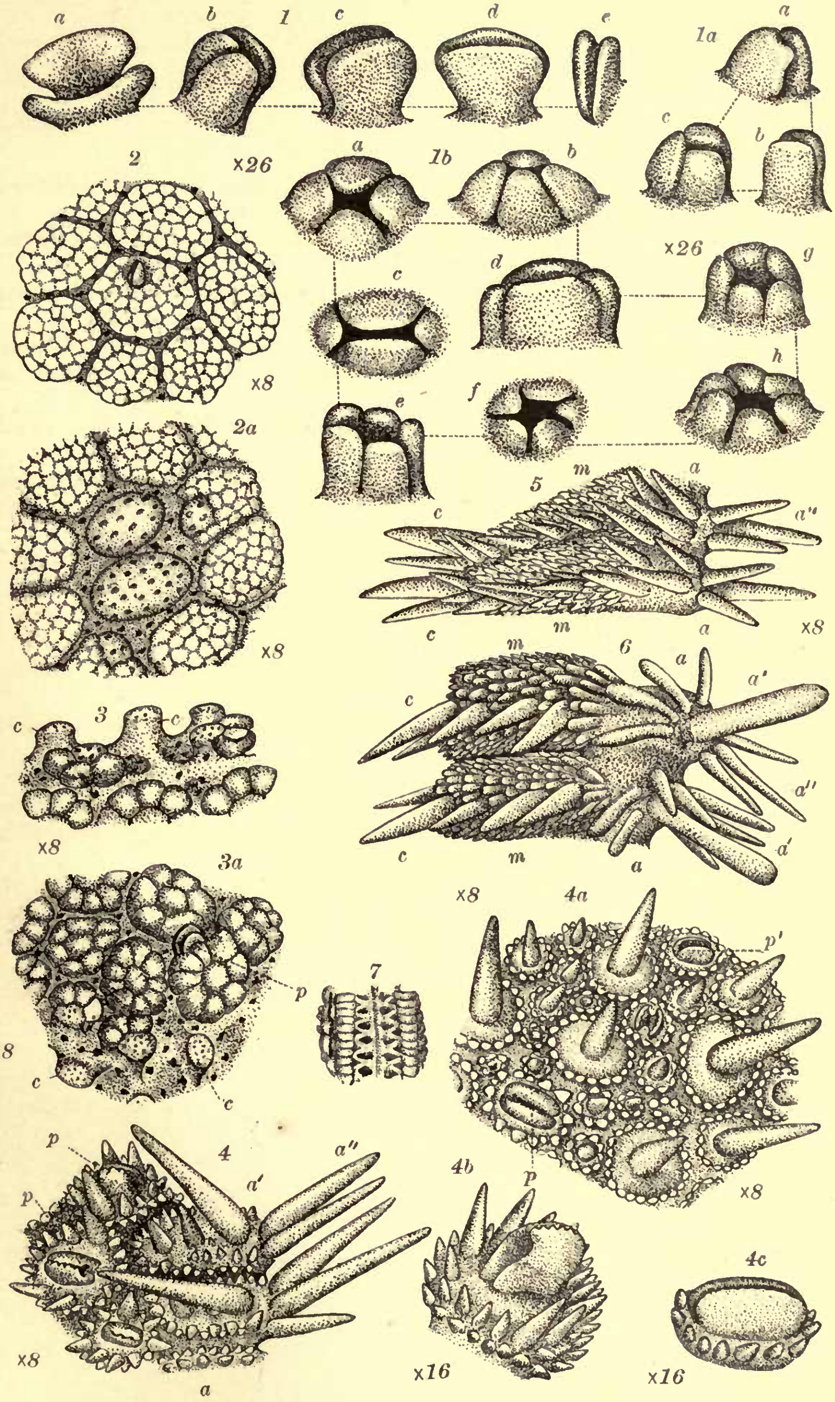
FIG. 4*b*. The same specimen. One of the dorsal plates with a pedicellaria; × about 16.

FIG. 4*c*. The same. A dorsal pedicellaria of the broad form; × about 16.

FIG. 5. *Astropecten californicus* Fisher. Actinal side; *a', a',* inner, and *a, a,* outer adambulacral spines; *m, m,* inferomarginal plates; *c, c,* inferomarginal spines; × 8.

FIG. 6. *Astropecten siderealis* Verrill. Actinal side; *a, a,* outer adambulacral spines; *a',* central spine of the adambulacral plate; *a″,* furrow spines; *c, c,* inferomarginal spines; *m, m,* inferomarginal plates; × 8.

FIG. 7. *Stenasterias macropora* Verrill. Type. Portion of the actinal side of a ray, with the spines removed; × 5.



A. HYATT VERRILL DEL.

HELIOTYPE CO., BOSTON

1-1b. Dermasterias imbricata (Grube)
2.2a. Ceramaster granularis (M.)
3.3a. Tosiaster arcticus Ver.
4-4c. Hippasteria spinosa Ver.
5. Astropecten californicus F. 6. A. siderealis Ver.
7. Stenasterias macropora Ver.

— same as 1909b. p. 64

51

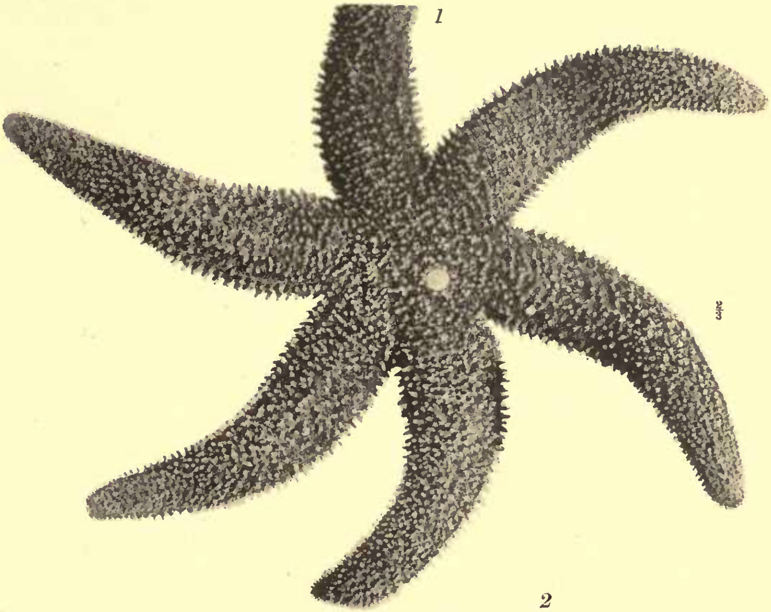
51

PLATE LI.

FIG. 1. *Asterias katherinæ* Gray. Dorsal view of No. 1181, Mus. Comp. Zoöl.; ⅔ natural size. Gulf of Georgia.

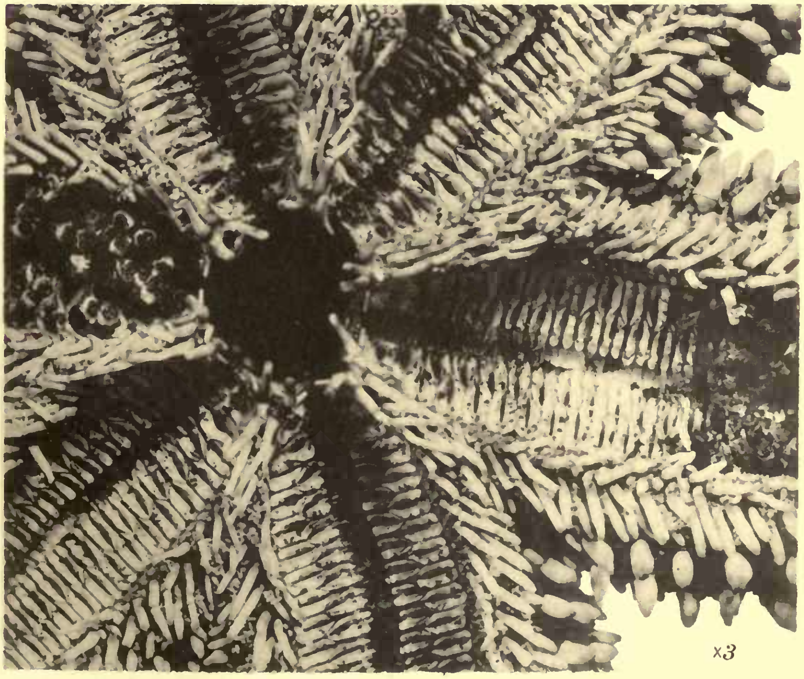
FIG. 2. The same specimen. Actinal side; × 3.

1



2/3

2



x3

HELIOTYPE CO., BOSTON

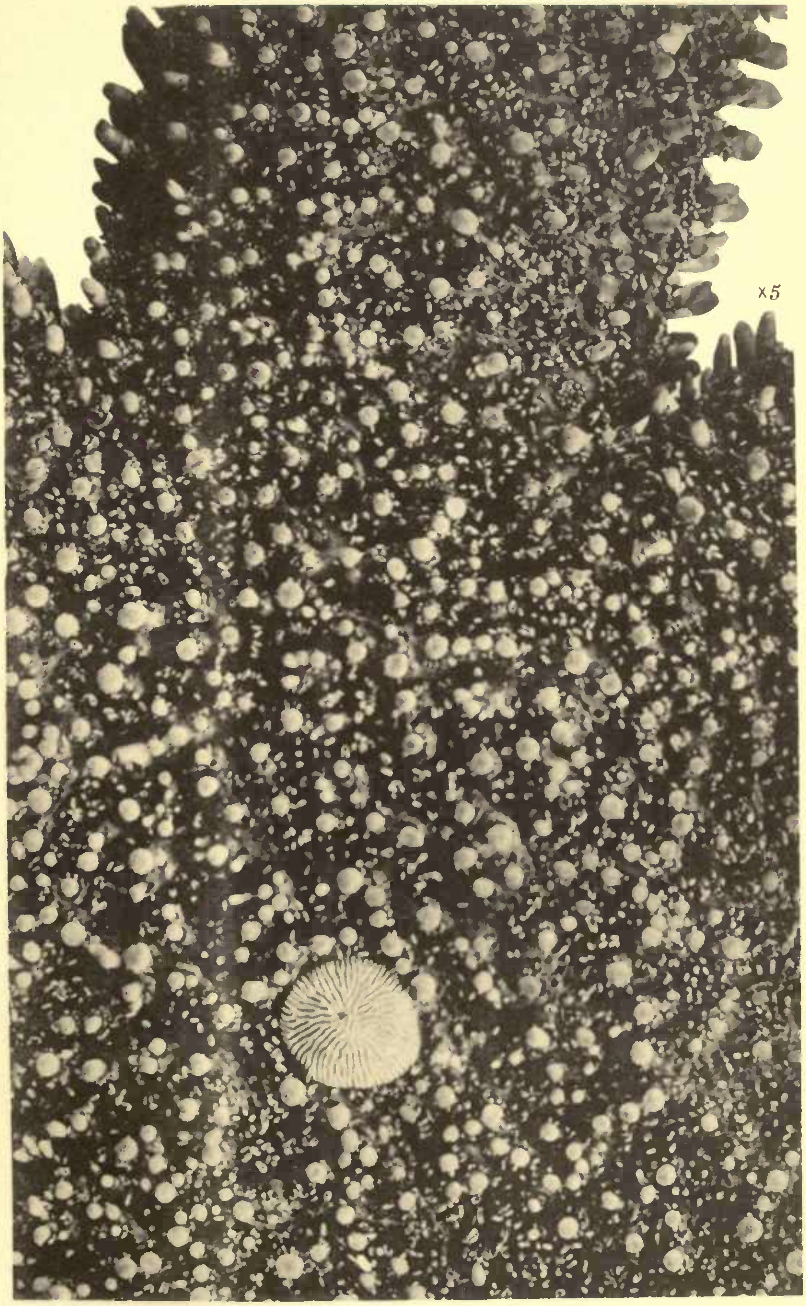
1.2. Asterias katherinae Gray

52

52

PLATE LII.

Asterias katherinæ Gray. Dorsal side of the same specimen shown on pl. LI; × 4⅜. Gulf of Georgia. No. 1181, Mus. Comp. Zoöl.



HELIOTYPE CO., BOSTON

Asterias katherinae Gray

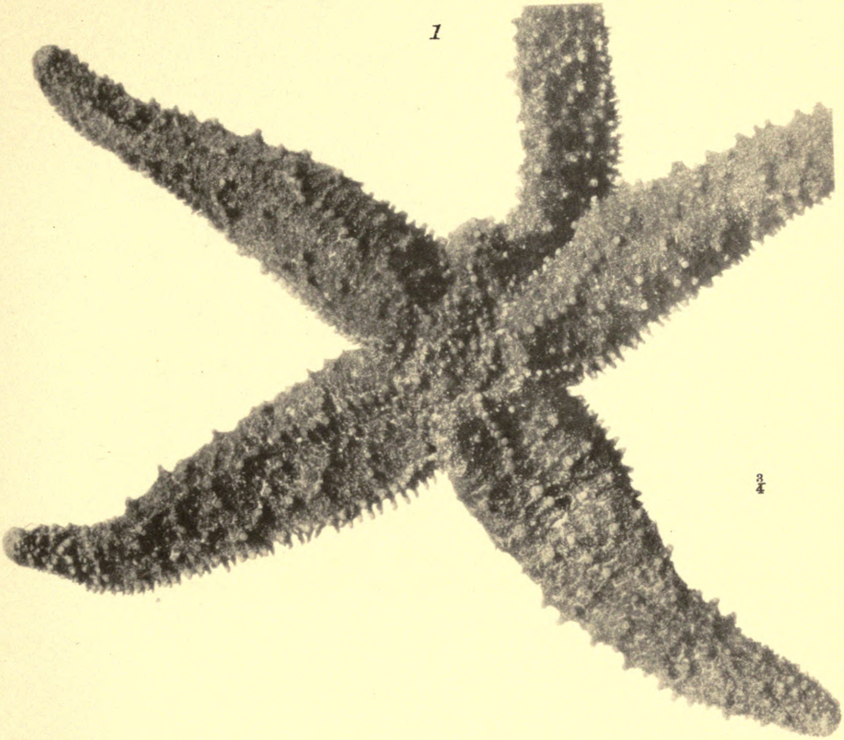
53

53

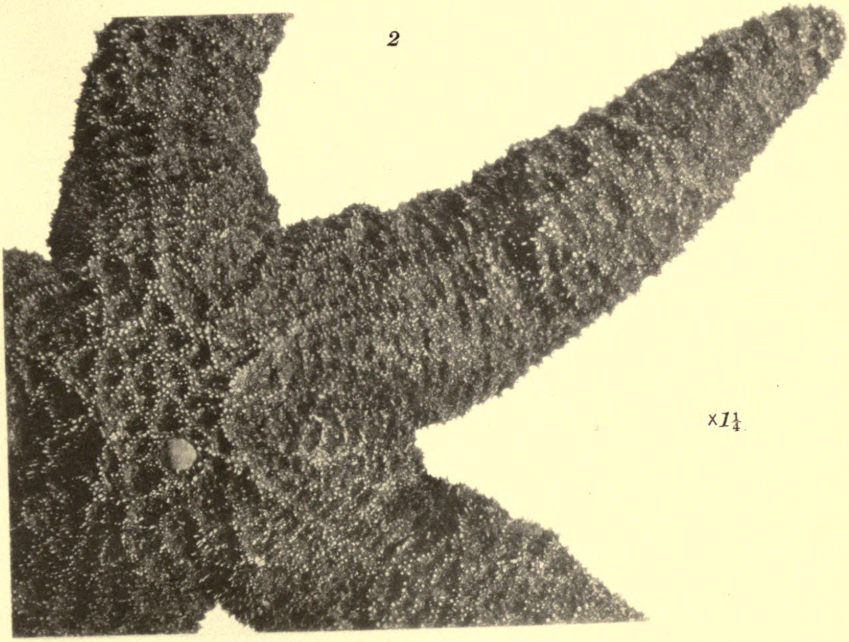
PLATE LIII.

FIG. 1. *Asterias victoriana* Verrill. Type. Dorsal view; ¾ natural size.
FIG. 2. *Pisaster confertus* (Stimpson) Verrill. × about 1⅛.

1



2



HELIOTYPE CO., BOSTON

1. Asterias victoriana Ver. Type
2. Pisaster confertus (St.)

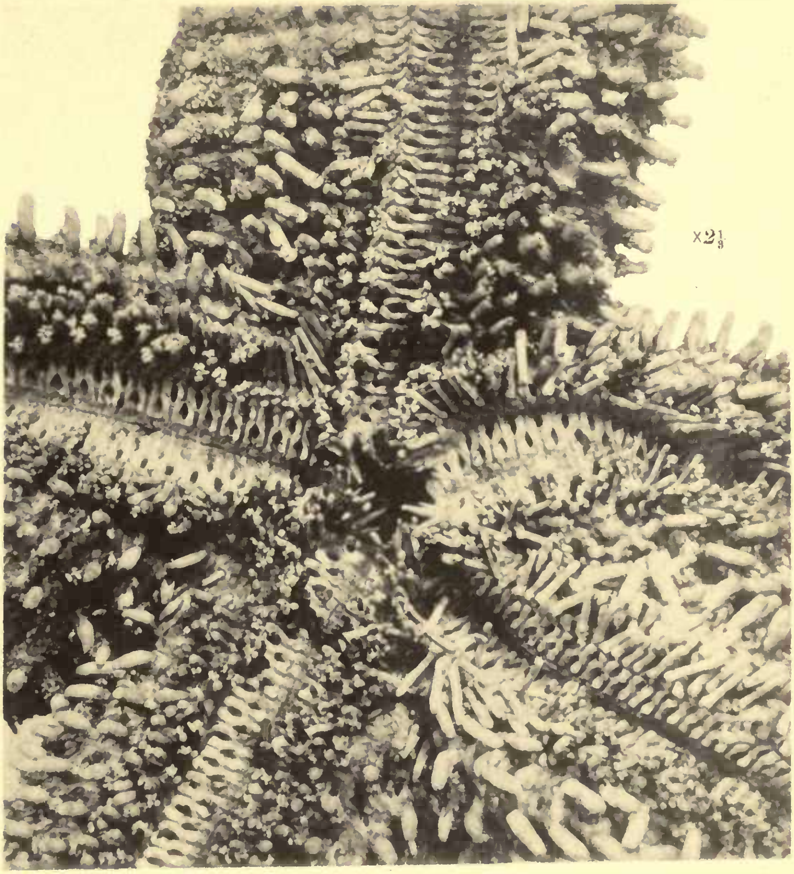
54

54

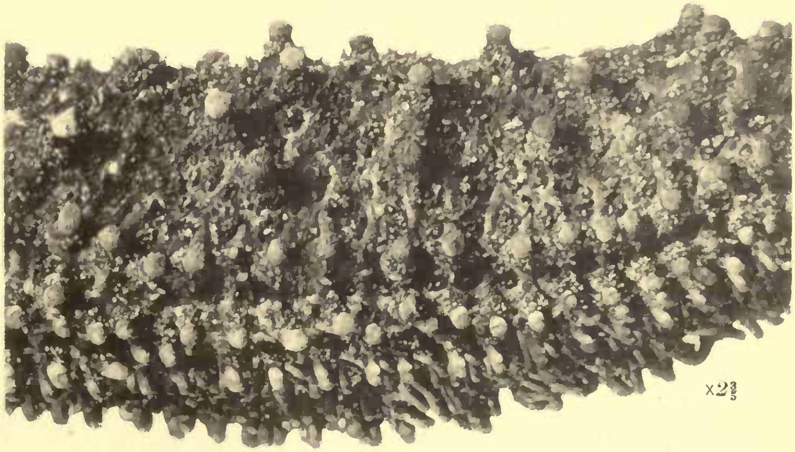
PLATE LIV.

FIG. 1. *Asterias victoriana* Verrill. Type. Actinal side; × 2⅓.
FIG. 2. The same specimen. Side view of a ray; × 2⅝. Vancouver I.

1



2



HELIOTYPE CO., BOSTON

1.2. Asterias victoriana Ver. Type

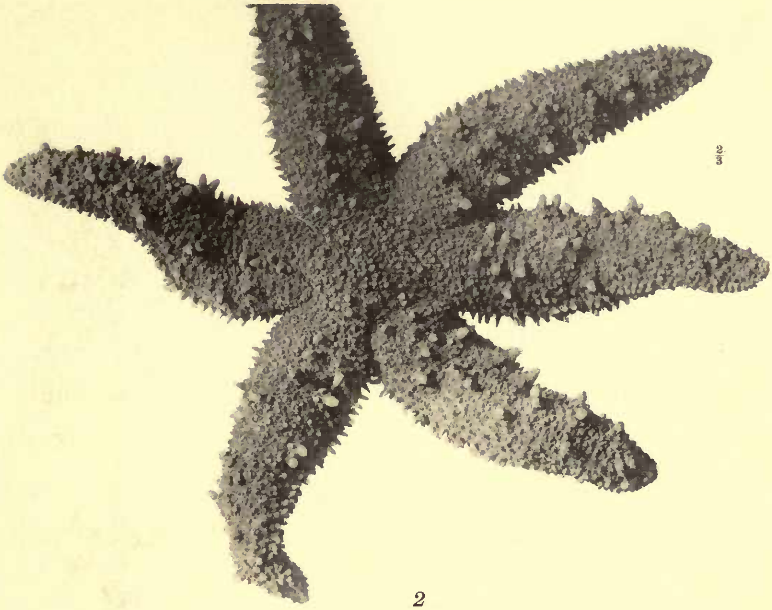
55

55

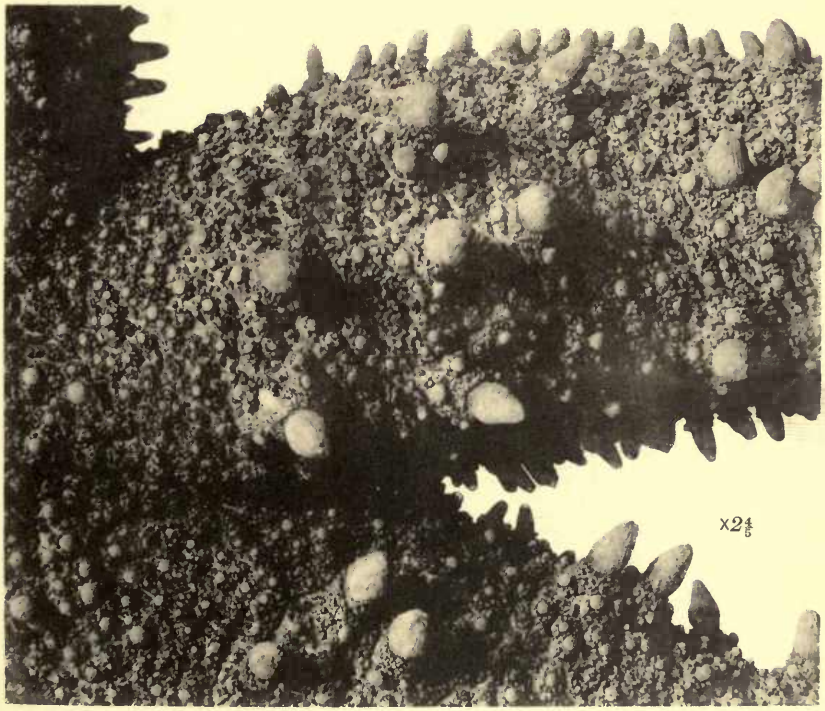
PLATE LV.

FIG. 1. *Asterias polythela* Verrill. Type. Dorsal side; about ⅔ natural size.
FIG. 2. The same specimen. Part of dorsal side; × 2⅘. No. 5820.

1



2



HELIOTYPE CO., BOSTON

1.2. ARTERIAS POLYTHELA VER. Type

26

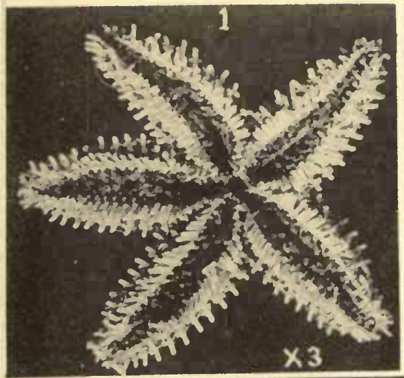
56

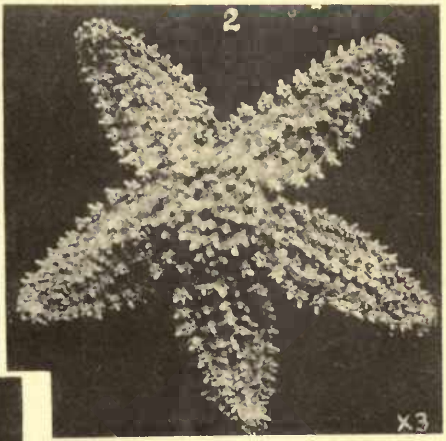
PLATE LVI.

new

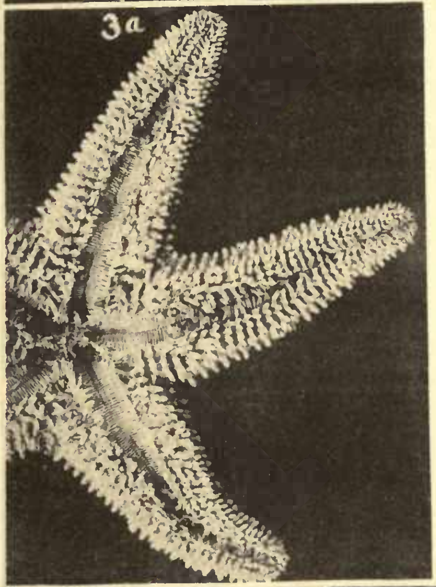
FIGS. 1, 2.	*Leptasterias arctica* (Murdoch) (?). Young. Actinal and dorsal views of specimens from Bering Sea; × 3. No. 16591, U. S. Nat. Mus.
FIGS. 3, 3*a*.	*Pisaster ochraceus,* var. *nodiferus* Verrill. Dorsal and actinal views; about ⅔ natural size (*nodosus* on plate incorrect).
FIG. 4.	*P. capitatus* (Stimpson) Verrill. Dorsal side of two rays; about ⅔ natural size.
FIG. 5.	*Leptasterias æqualis* (Stimpson), var. *compacta* Verrill. Type. Dorsal side; × 2. Yale Mus.

arctica

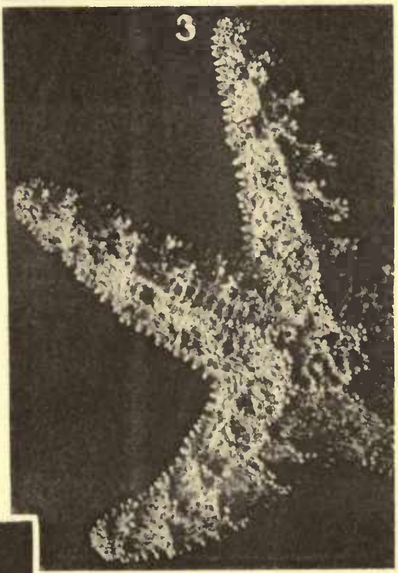

1

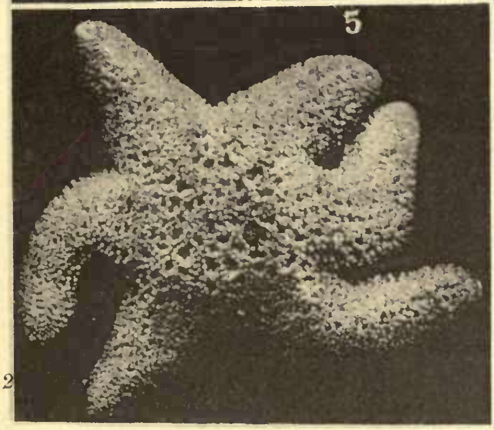

2

arctica

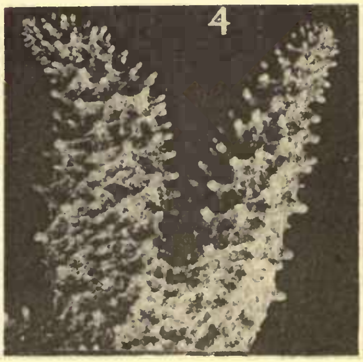

3a

ochraceus


3


5

nalis


4

capitatus

HELIOTYPE CO., BOSTON

1.2. Leptasterias arctica (Mur.) Young
3.3a. Pisaster ochraceus nodosus Ver.
4. Pisaster capitatus (St.)
5. Leptasterias aequalis compacta Ver.

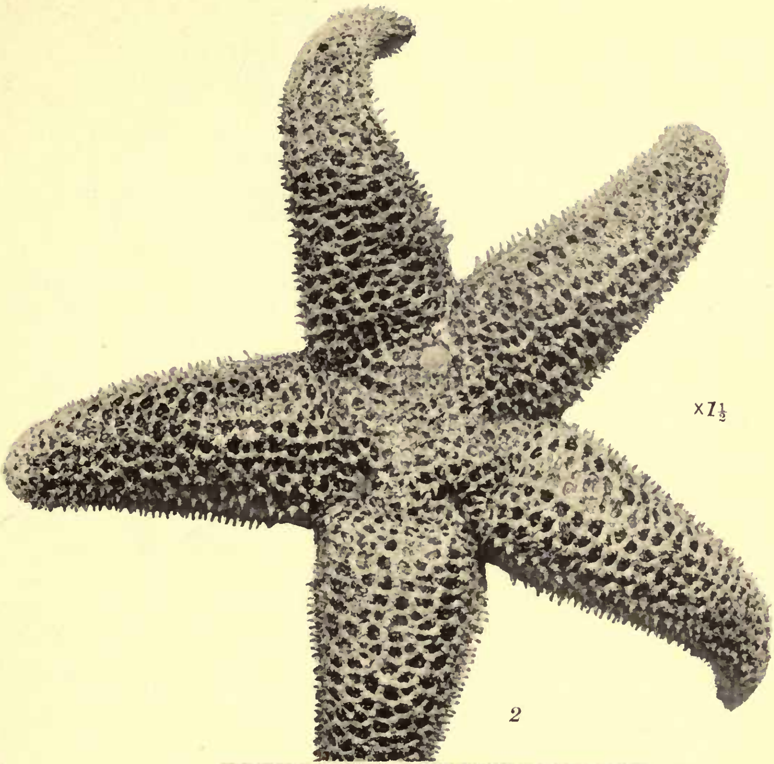
57

57

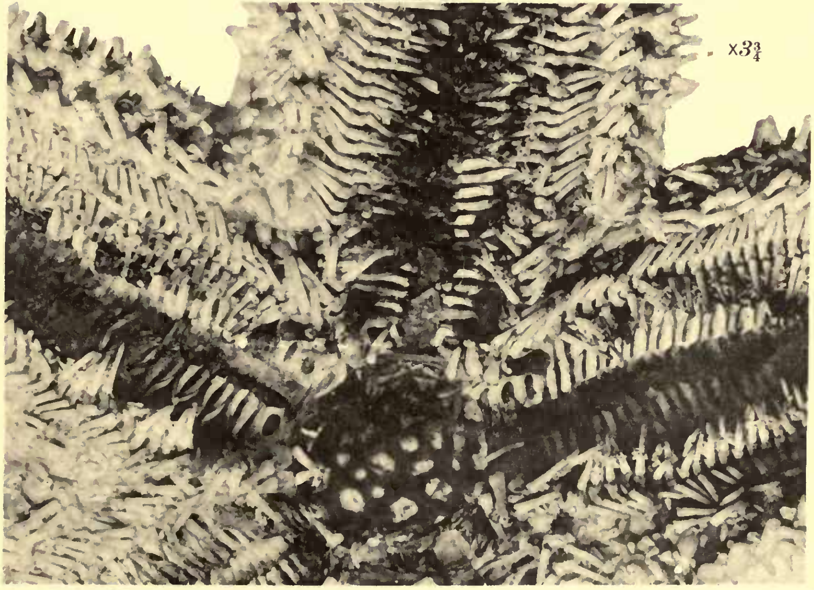
PLATE LVII.

FIG. 1. *Parasterias albertensis* Verrill. Type. Dorsal side; × 1½.
FIG. 2. The same specimen. Actinal side; × 3¾.

1



2



HELIOTYPE CO., BOSTON

1.2. Parasterias albertensis Ver. Type

58

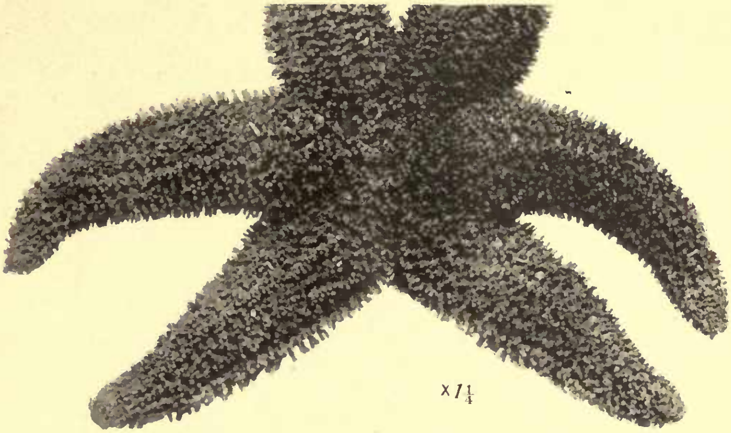
58

PLATE LVIII.

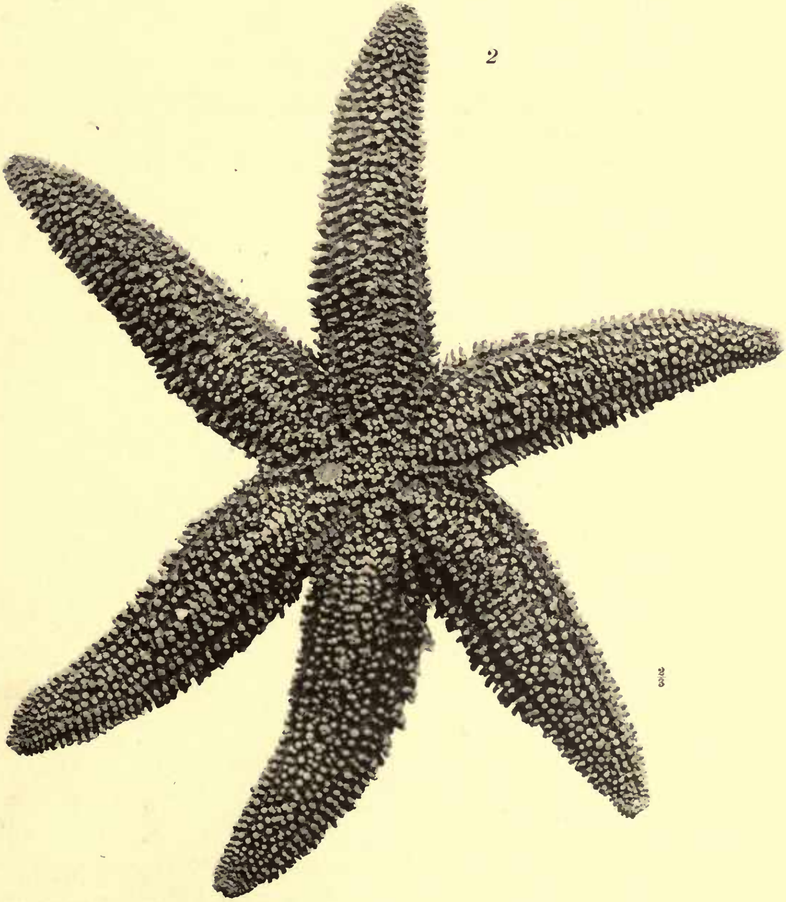
FIG. 1. *Leptasterias epichlora,* var. *plena* Verrill. Type. Dorsal view; × 1¼. Vancouver I.

FIG. 2. *Asterias multiclava* Verrill. Type. About ⅔ natural size.

1



2



HELIOTYPE CO., BOSTON

1. Leptasterias epichlora plena Ver. Type
2. Asterias multiclava Ver. Type

59

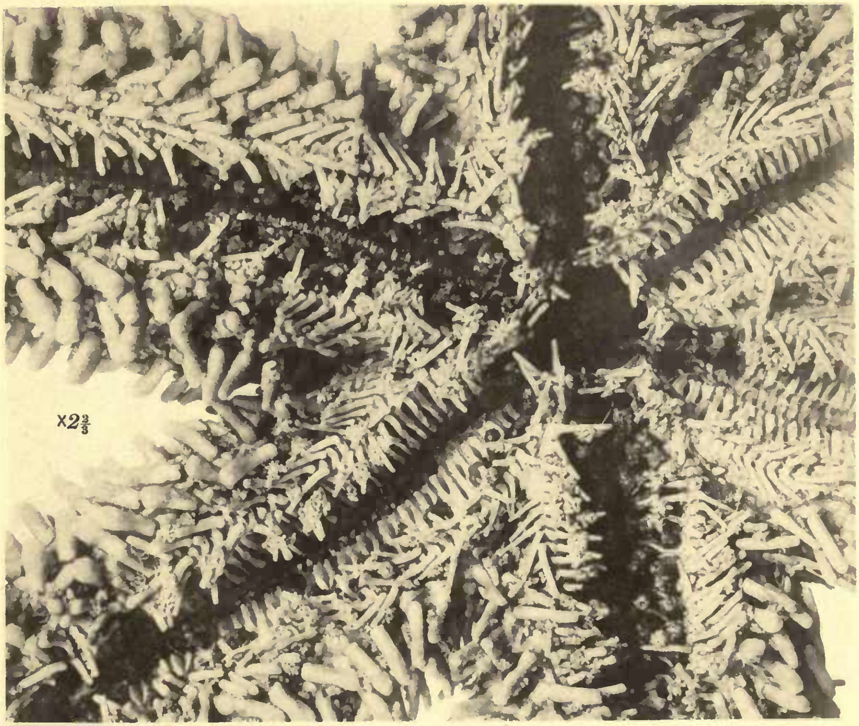
59

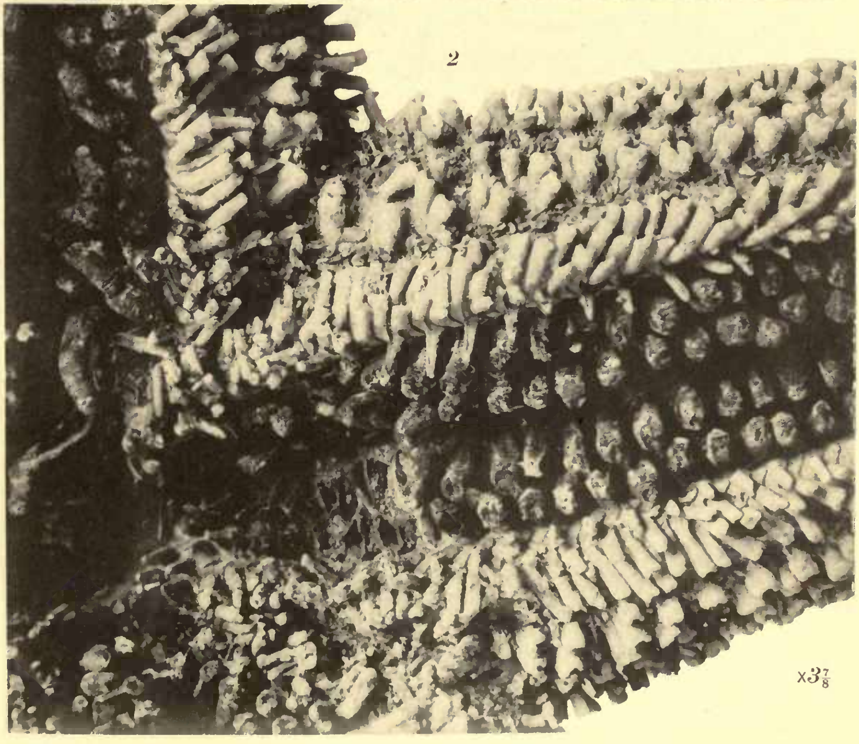
PLATE LIX.

Fig. 1. *Asterias multiclava* Verrill. Type. Actinal side; × 2⅔. Bering I. No. 15841, U. S. Nat. Mus.

Fig. 2. *Allasterias anomala* Verrill. Type. Actinal side; × 3⅞. Arctic Alaska (L. M. Turner, 1874). No. 3821, U. S. Nat. Mus.

1





HELIOTYPE CO., BOSTON

1. Asterias multiclava Ver. Type
2. Allasterias anomala Ver. Type

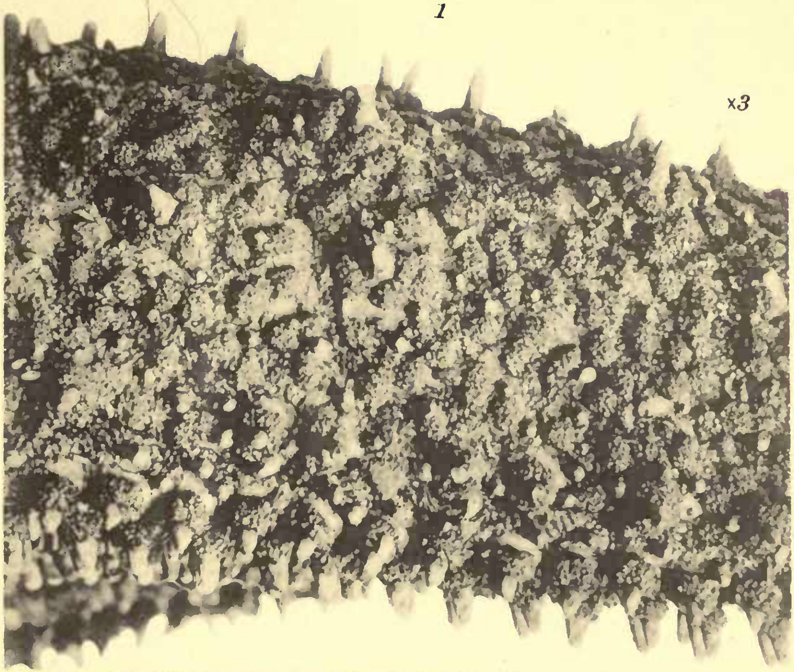
60

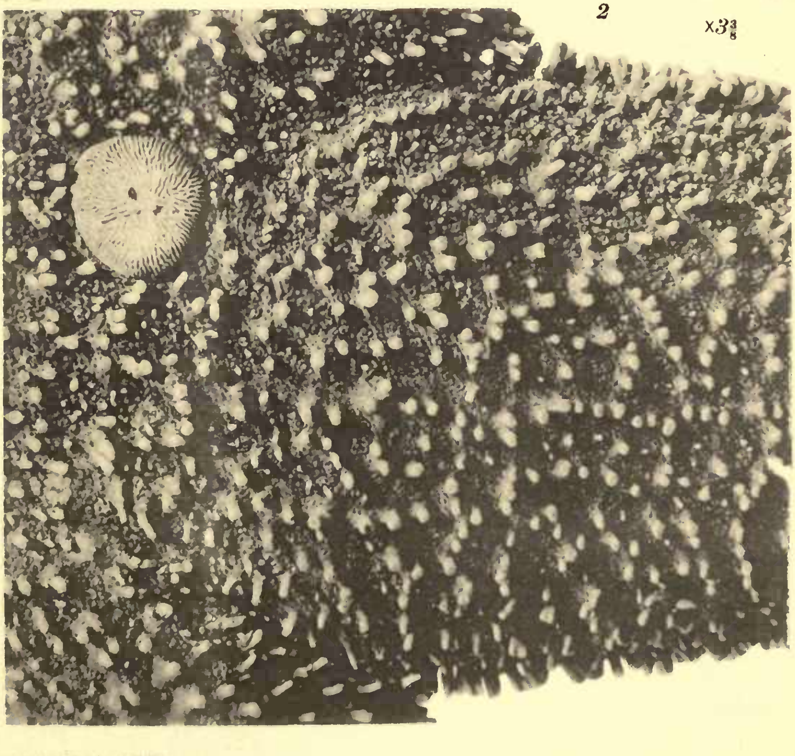
60

PLATE LX.

FIG. 1. *Pisaster papulosus* Verrill. Cotype. Side view of a ray, near base; × about 3. Vancouver I.

FIG. 2. *Allasterias anomala* Verrill. Type. Dorsal view; × 3⅜. St. Michael's I., Arctic Alaska (L. M. Turner). No. 3821, U. S. Nat. Mus.





HELIOTYPE CO., BOSTON

1. Pisaster papulosus Ver.
2. Allasterias anomala Ver. Type

61.

61

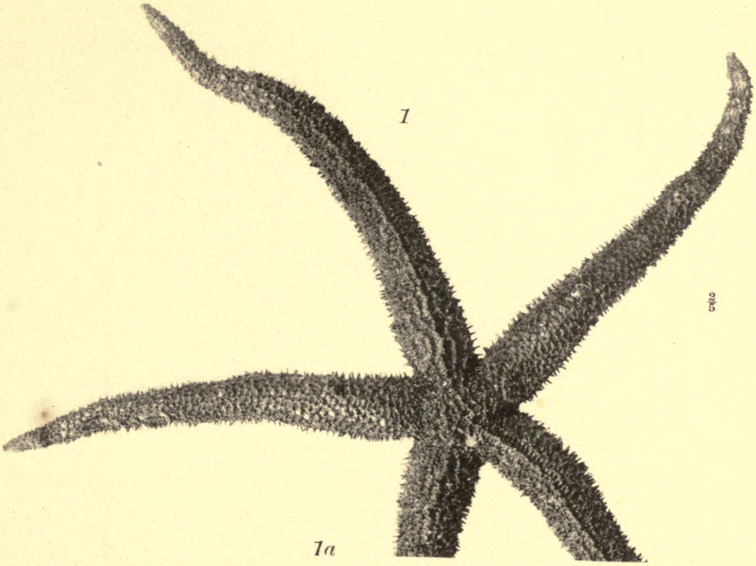
PLATE LXI.

FIG. 1. *Asterias nanimensis* Verrill. Type. Dorsal side; about ⅖ natural size. Vancouver I. Canadian Geol. Survey.

FIG. 1*a*. The same specimen. Side view of a ray; × 2½.

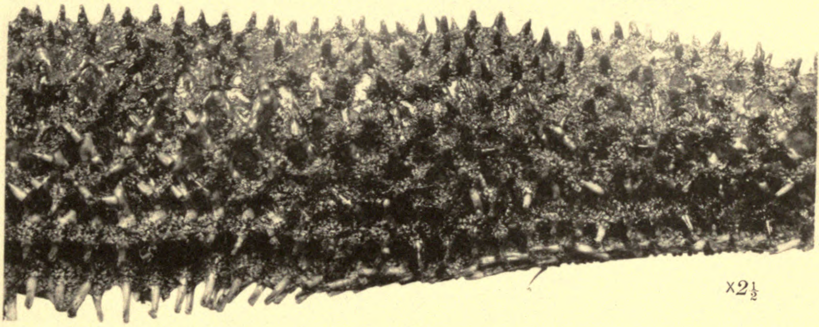
FIG. 1*b*. The same specimen. Actinal side of a ray; × 2.

1



2/5

1a



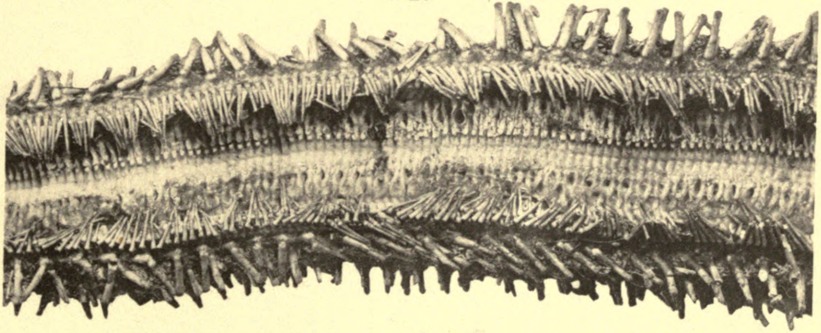
— verrill's sup.

— true sup.

— inf (= V's act.)

×2½

1b



×2

HELIOTYPE CO., BOSTON

1.1b. Asterias manimensis Ver. Type

62

62

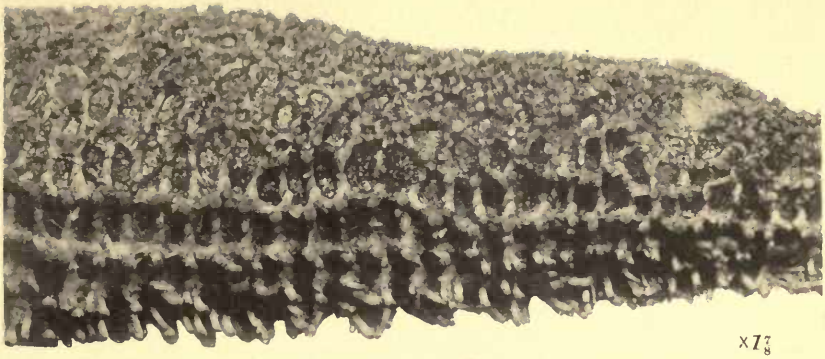
PLATE LXII.

FIG. 1. *Evasterias troschelii,* var. *alveolata* Verrill. Type. Side view of a ray; × 1⅞.

FIG. 2. *Orthasterias forreri forcipulata* Verrill. Type. Dorsal view of a ray; ×1⅜. Vancouver I.

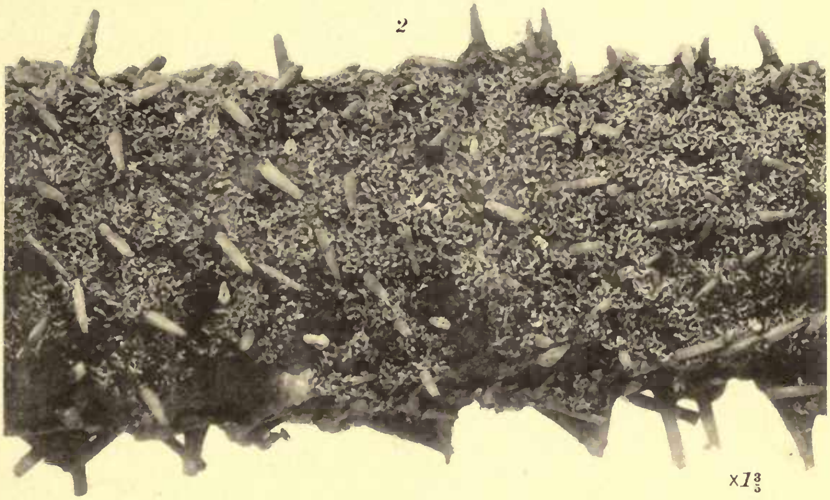
FIG. 3. The same specimen. Actinal side of a ray; × 1⅜.

1



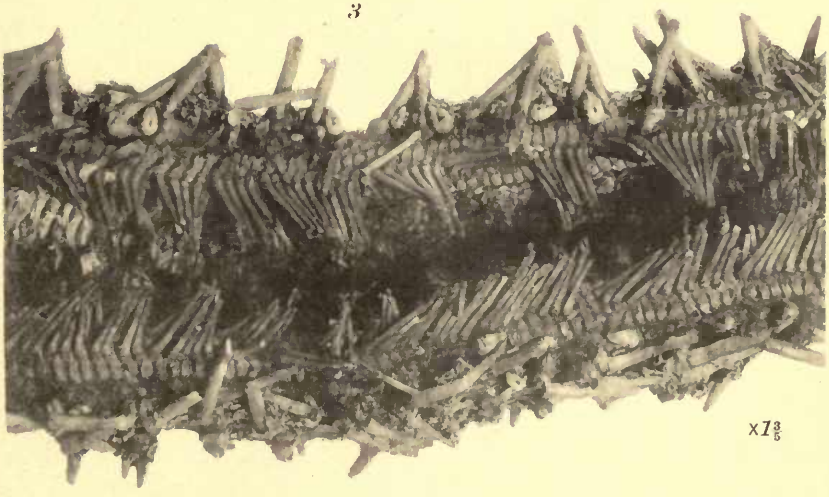
$\times 1\frac{7}{8}$

2



$\times 1\frac{3}{5}$

3



$\times 1\frac{3}{5}$

HELIOTYPE CO., BOSTON

1. Evasterias troschelii alveolata Ver. Type
2.3. Orthasterias forreri forcipulata Ver. Type

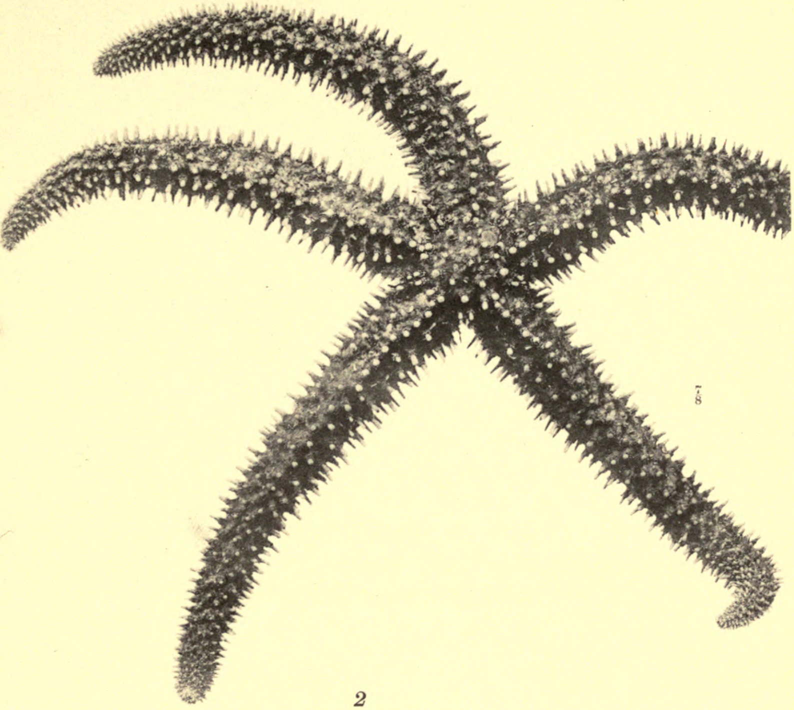
63

63

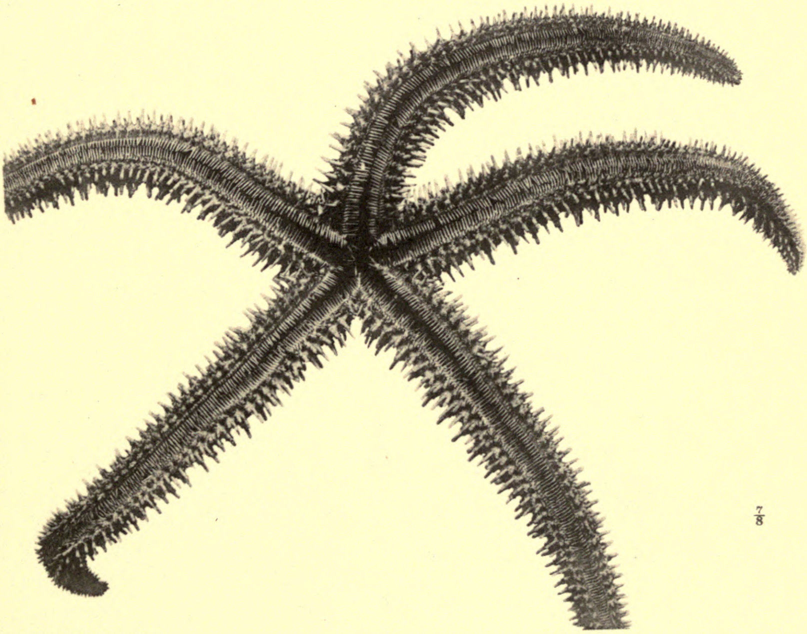
PLATE LXIII.

Fig. 1. *Orthasterias biordinata* Verrill. Type. About ⅞ natural size.
Fig. 2. The same specimen. Actinal side; ⅞ natural size.

1



2



HELIOTYPE CO., BOSTON

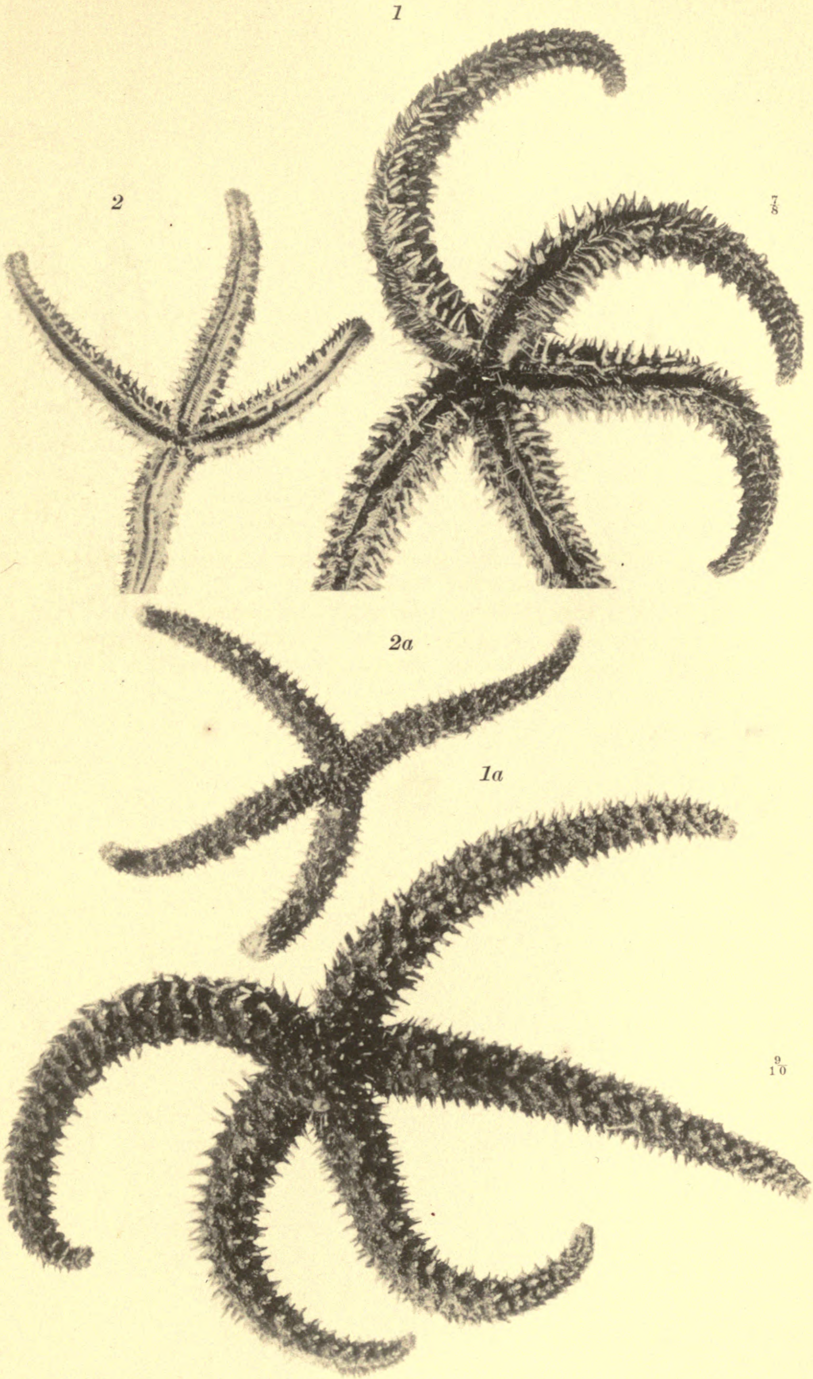
1.2. ORTHASTERIAS BIORDINATA VER. Type

64

64

PLATE LXIV.

Fig. 1. *Orthasterias leptolena* Verrill. Type. Actinal side; about ⅞ natural size. Canadian Geol. Survey.
Fig. 1*a*. The same specimen. Dorsal side; ⅞ natural size.
Fig. 2. The same. A young specimen. Actinal side; 9/10 natural size.
Fig. 2*a*. The same specimen. Dorsal side; 9/10 natural size. One ray is lost.



HELIOTYPE CO., BOSTON

ORTHASTERIAS LEPTOLENA VER. Type

65

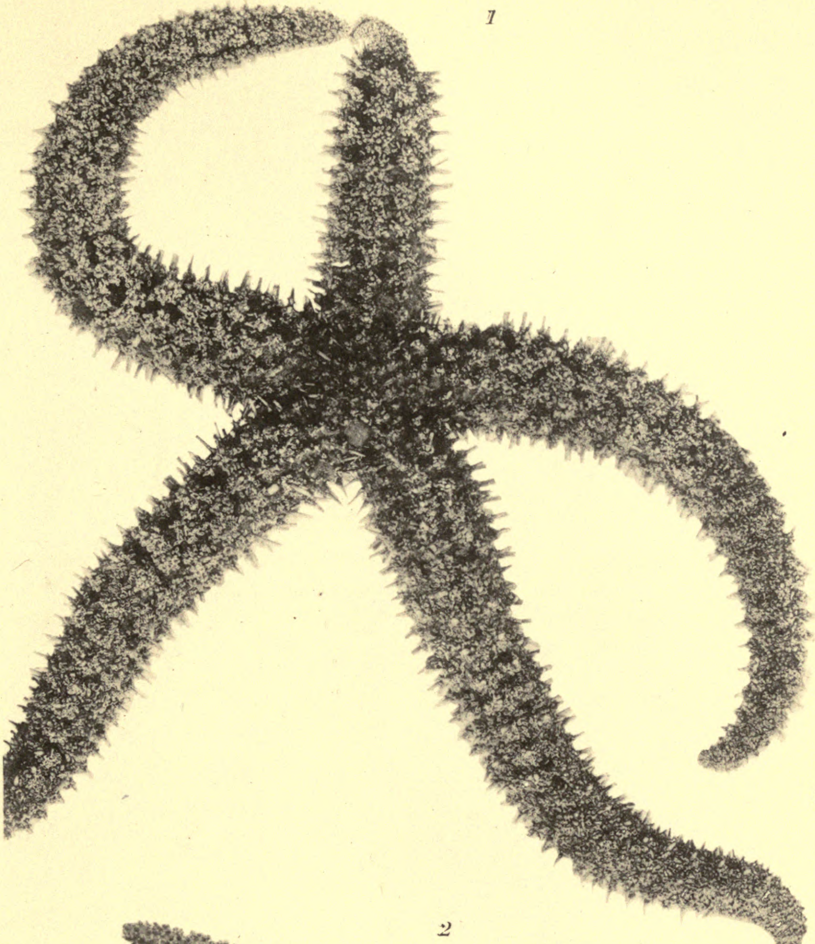
65

PLATE LXV.

FIG. 1. *Orthasterias forreri* (de Loriol) Verrill. Dorsal side; about 4/5 natural size. No. 1823, Mus. Comp. Zoölogy.

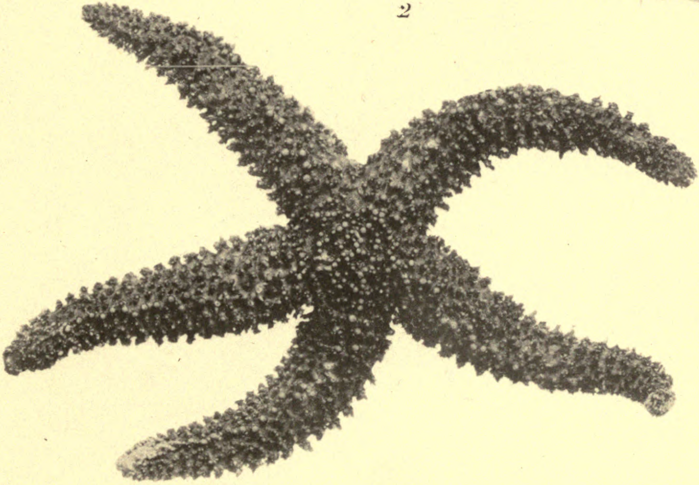
FIG. 2. *Orthasterias columbiana* Verrill. Young. Dorsal side; about natural size.

1



4/5

2



1/1

HELIOTYPE CO., BOSTON

1. ORTHASTERIAS FORRERI (LOR.)
2. O. COLUMBIANA VER. YOUNG

66

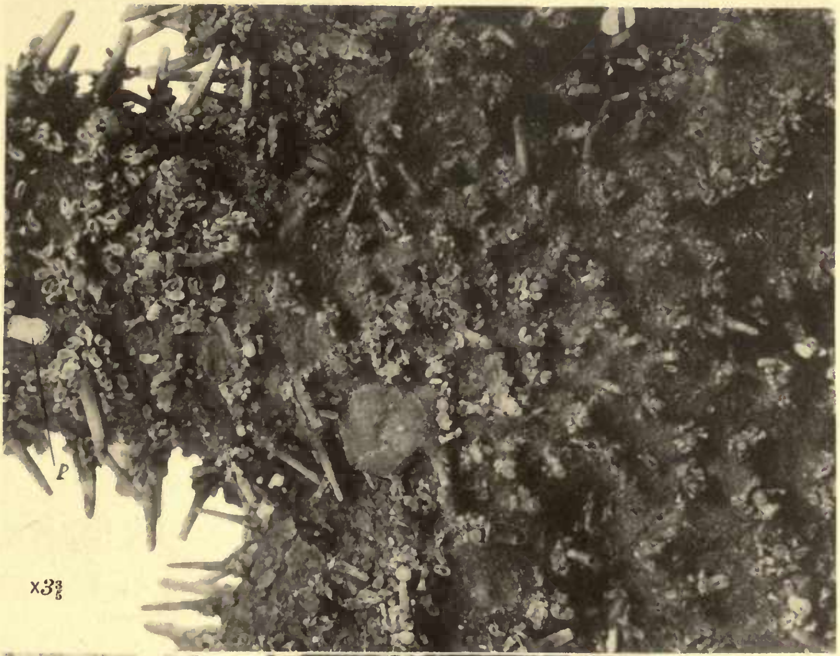
66

PLATE LXVI.

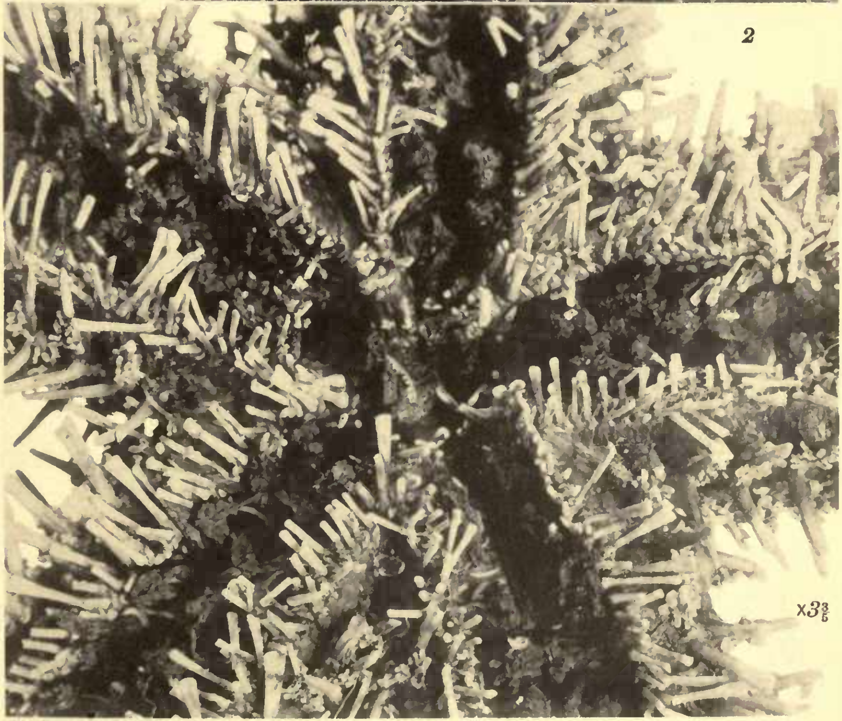
FIG. 1. *Orthasterias forreri* (Loriol) Verrill. Dorsal view of disk and base of ray; *P,* major pedicellaria; × 3⅗. No. 1823.

FIG. 2. The same specimen. Actinal side; × 3⅔. No. 1823, Mus. Comp. Zoöl.

1



2



HELIOTYPE CO., BOSTON

1.2. Orthasterias forreri (Lor.)

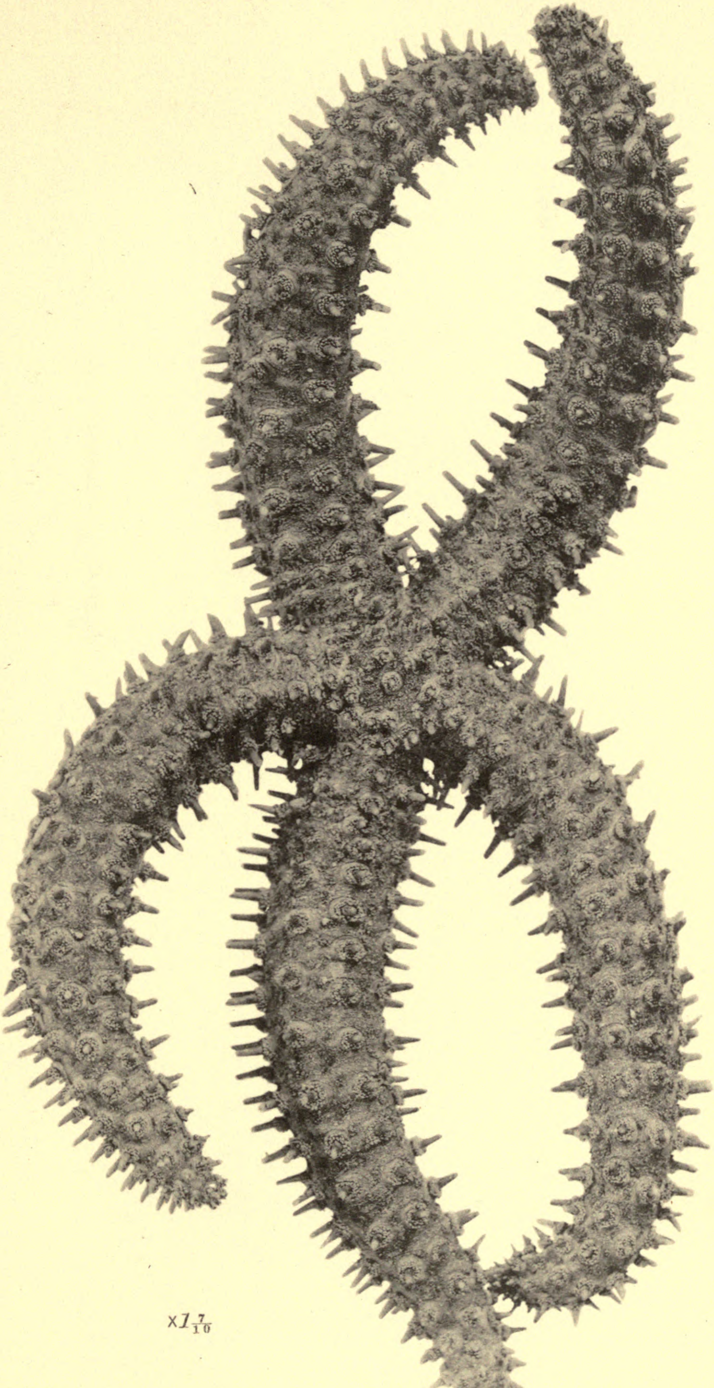
67

67

PLATE LXVII. ?

Orthasterias gonolena Verrill. Dorsal view; × 1⅗. Off San Francisco. Yale Mus.

not seen – not same specimen as type of Calif.



X$1\frac{7}{10}$

HELIOTYPE CO., BOSTON

ORTHASTERIAS GONOLENA VER.

68

68

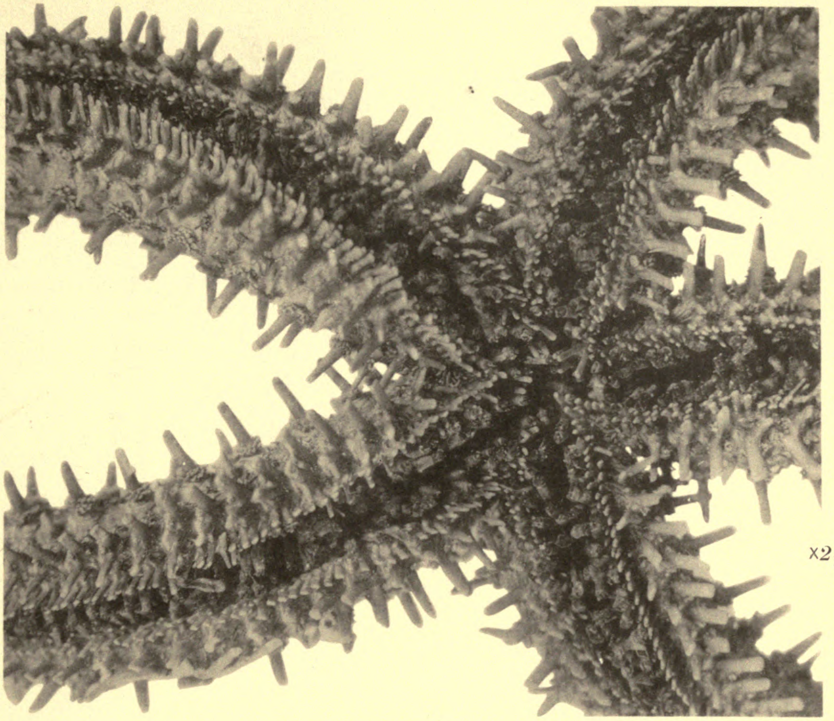
PLATE LXVIII.

FIG. 1. *Orthasterias gonolena* Verrill. Ventral view of the same specimen as in pl. LXVII; × 2½.

FIG. 2. *Orthasterias californica* Verrill. Type. Actinal side; × 3⅛.

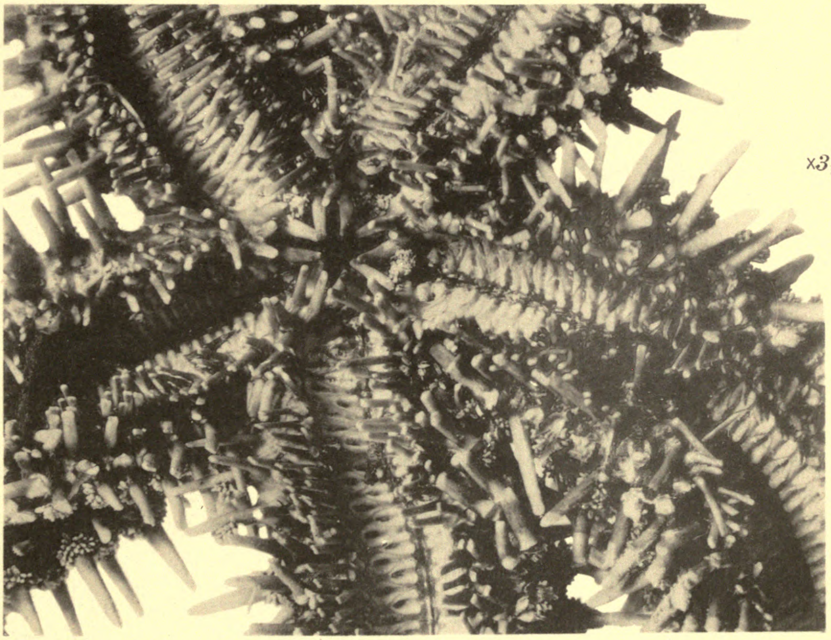
68

1



×2½

2



×3⅛

HELIOTYPE CO., BOSTON

1. ORTHASTERIAS GONOLENA VER.
2. O. CALIFORNICA VER. Type

69

69

PLATE LXIX.

FIG. 1. *Asterias multiclava* Verrill. Type. Portion of the actinal side of a ray; × about 4½.

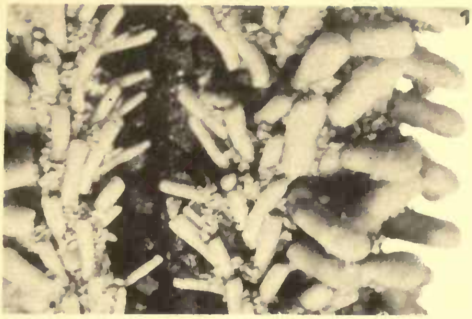
FIG. 2. *Orthasterias gonolena* Verrill. Portion of the actinal side of a ray; × 4.

FIG. 3. *Pisaster brevispinus* (Stimpson) Verrill. Portion of actinal side of a ray; × 3.

FIG. 4. *Asterias victoriana* Verrill. Type. Portion of the actinal side of a ray; × 2⅔.

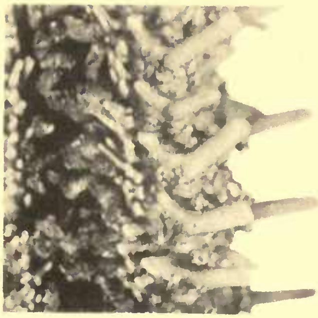
FIG. 5. *Allasterias anomala* Verrill. Type. Portion of the actinal side of a ray; × 5⅘. St. Michael, Alaska (L. M. Turner, 1874).

1



x4½

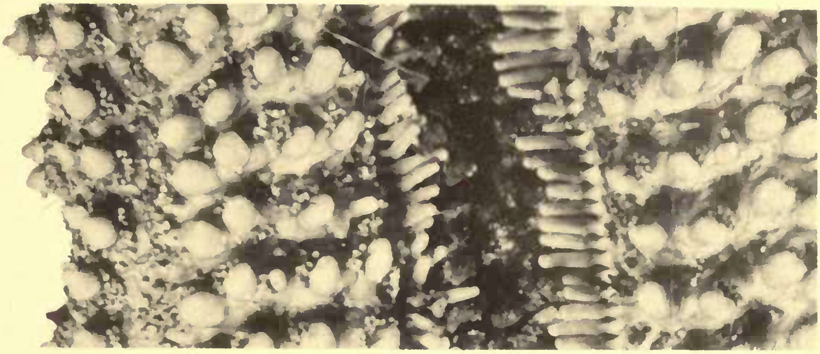
2



x4

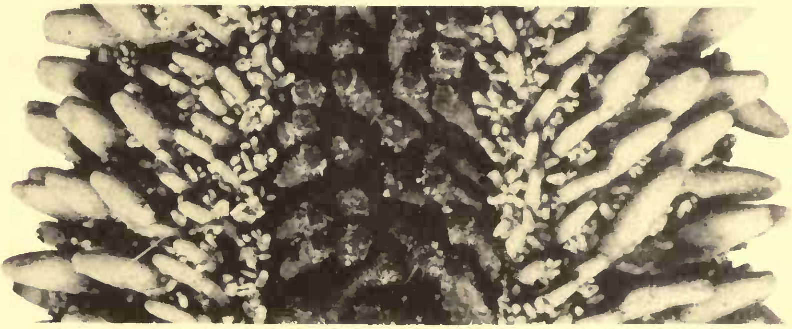
gonolena

3



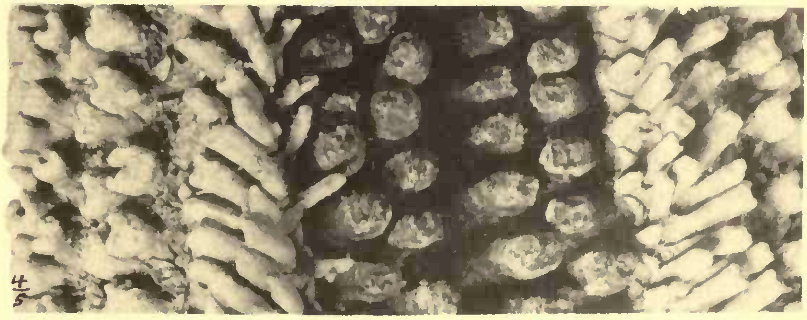
x3

4



x2⅔

5



5⅘

HELIOTYPE CO., BOSTON

1. Asterias multiclava Ver. Type
2. Orthasterias gonolena Ver.
3. Pisaster brevispinus (St.)
4. Asterias victoriana Ver.
5. Allasterias anomala Ver. Type

70

70

PLATE LXX.

FIG. 1. *Urasterias linckii* (Müller and Troschel) Verrill. Portion of the actinal side of a ray of a North Atlantic specimen; × 3.

FIG. 2. The same specimen. Portion of the dorsal side of a ray; × 3.

FIG. 3. The same specimen. Madreporite with surrounding pedicellariæ and spines; × 3.

FIG. 4. The same specimen. Nephridial pore or so-called "anal pore" and surrounding pedicellariæ; × 3.

FIG. 5. *Orthasterias californica* Verrill. Type. Portion of the actinal side of a ray; × 4¾.

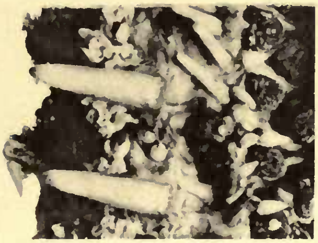
FIG. 6. *Parasterias albertensis* Verrill. Type. Portion of the actinal side of a ray; × 5. British Columbia. Yale Mus.

FIG. 7. *Orthasterias forreri* (Loriol) Verrill. Type. Portion of the dorsal side of a ray, showing the very large minor pedicellariæ; × 5⅗.

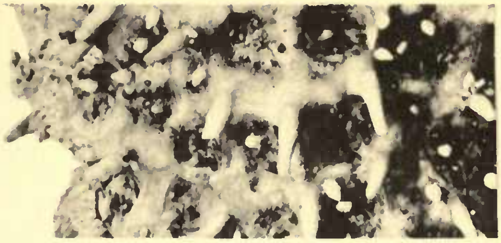
FIG. 8. *Asterias polythela* Verrill. Type. Portion of the dorsal side of a ray; × 4. Arctic America; Steamer Corwin. No. 15820.

FIG. 9. *Orthasterias forreri forcipulata* Verrill. Type. Portion of the side of a ray; × 2.

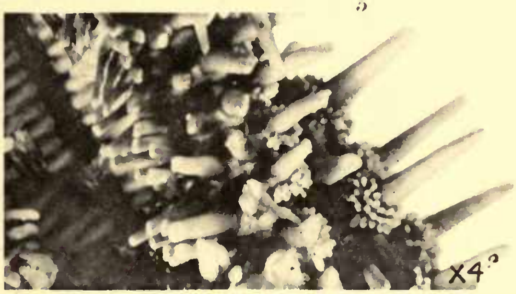
1

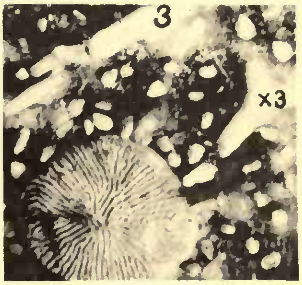


2

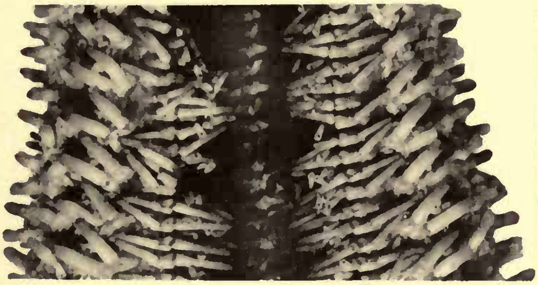


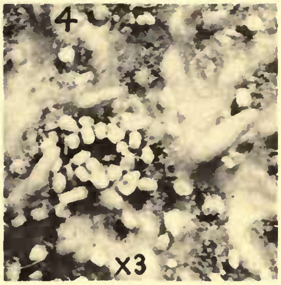
5



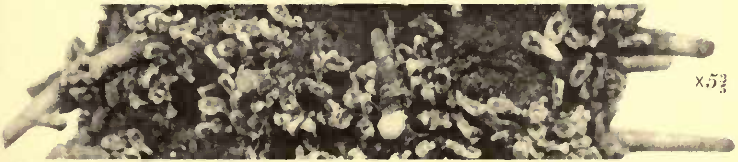


6

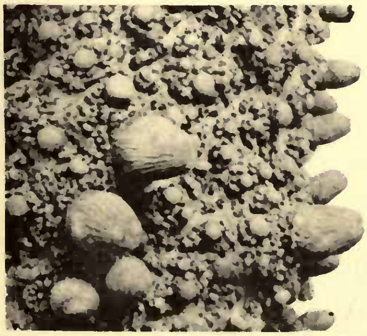




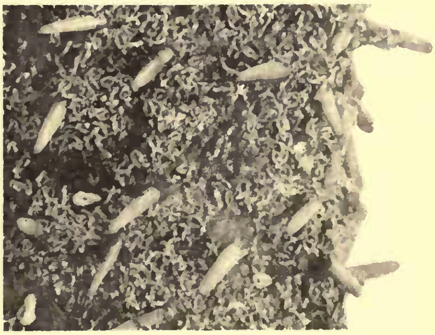
7



8



9



HELIOTYPE CO., BOSTON

1-4. URASTERIAS LINCKII (M. & TR.) ATLANTIC
5. ORTHASTERIAS CALIFORNICA VER. Type
6. PARASTERIAS ALBERTENSIS VER. Type
7. ORTHASTERIAS FORRERI (LOR.)
8. ASTERIAS POLYTHELA VER. Type
9. ORTHASTERIAS FORRERI FORCIPULATA VER. Type

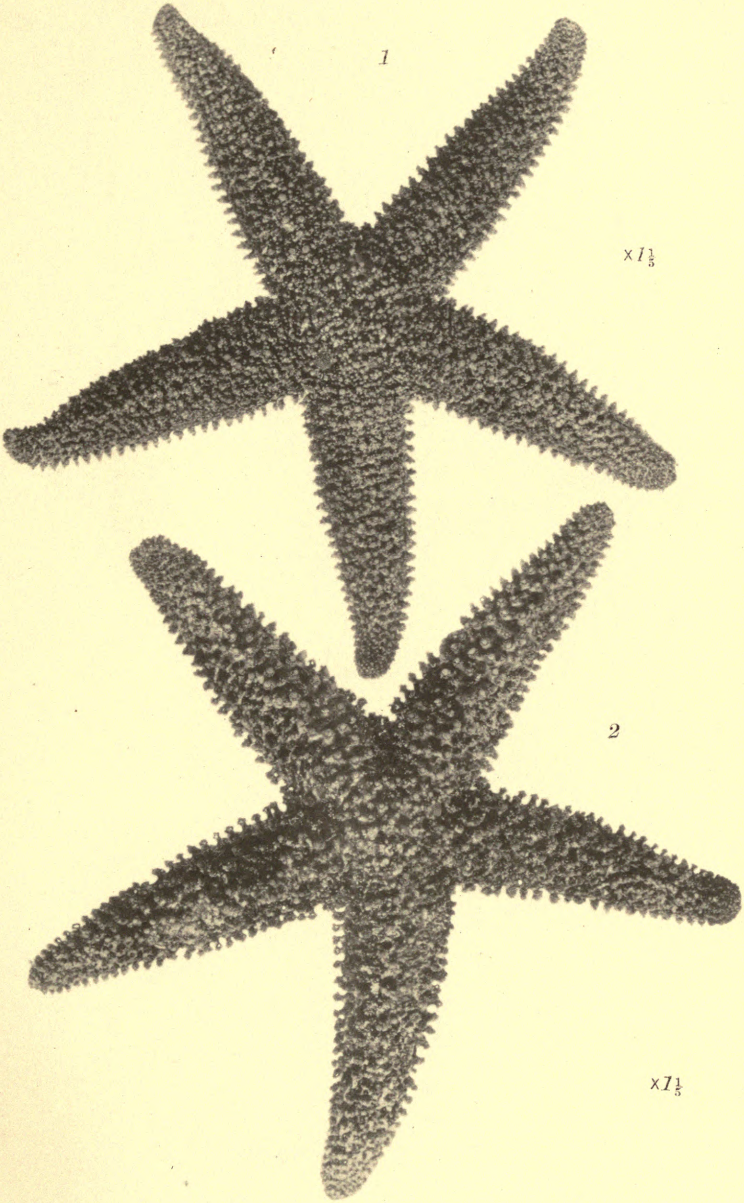
71

71

PLATE LXXI.

FIG. 1. *Leptasterias arctica* (Murdoch) Verrill. Dorsal side; × 1⅕. No. 1428, Mus. Comp. Zoöl.

FIG. 2. *L. arctica* (Murdoch). Dorsal side; × 1⅕. Same number. Both from Alaska.



HELIOTYPE CO., BOSTON

1.2. Leptasterias arctica (Mur.)

72

72

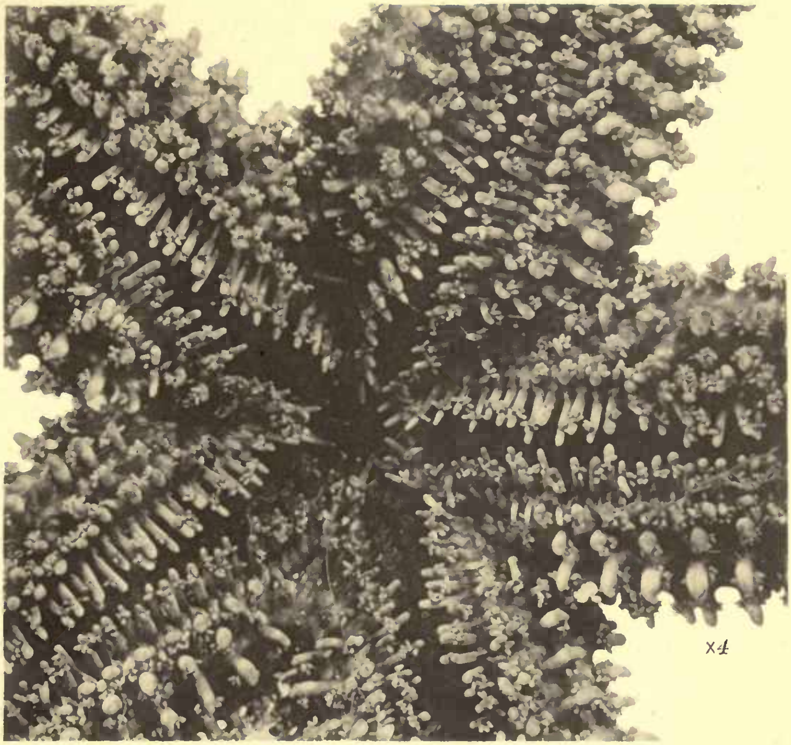
PLATE LXXII.

FIG. 1. *Leptasterias arctica* (Murdoch). Actinal side; × 4. Alaska. No. 1428. Mus. Comp. Zoöl.

FIG. 2. *Asterias polythela* Verrill. Type. Actinal side; × 3⅗. Arctic Alaska, Steamer Corwin. No. 15820.

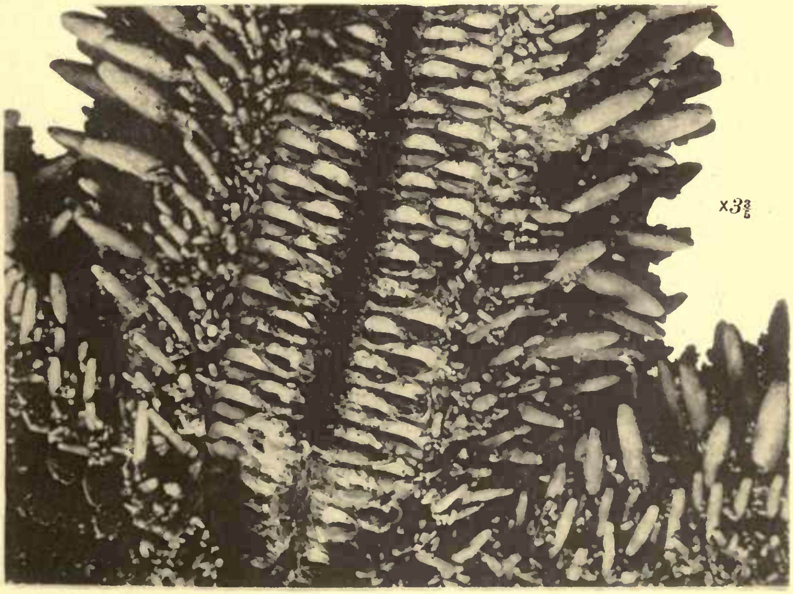
72

1



×4

2



×$3\frac{3}{5}$

HELIOTYPE CO., BOSTON

1. Leptasterias arctica (Mur.)
2. Asterias polythela Ver. Type

73

73

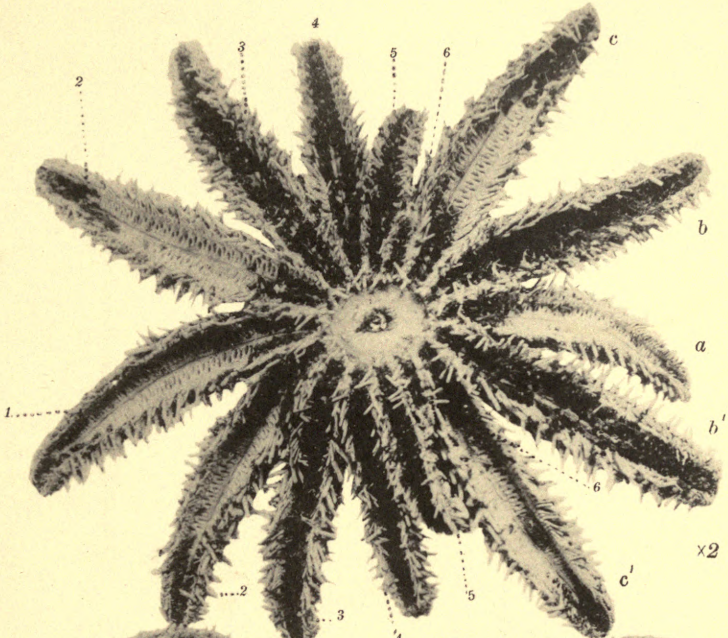
PLATE LXXIII.

FIG. 1. *Pycnopodia helianthoides.* Young, with sixteen rays, showing regular normal mode of interpolation of new rays; 1, odd anterior primary ray; 2, 3, 4, 5, 6, successive pairs of interpolated rays; *a,* odd posterior primary ray; *b, b′* and *c, c′* second and third pairs of primary posterior rays; × 2.

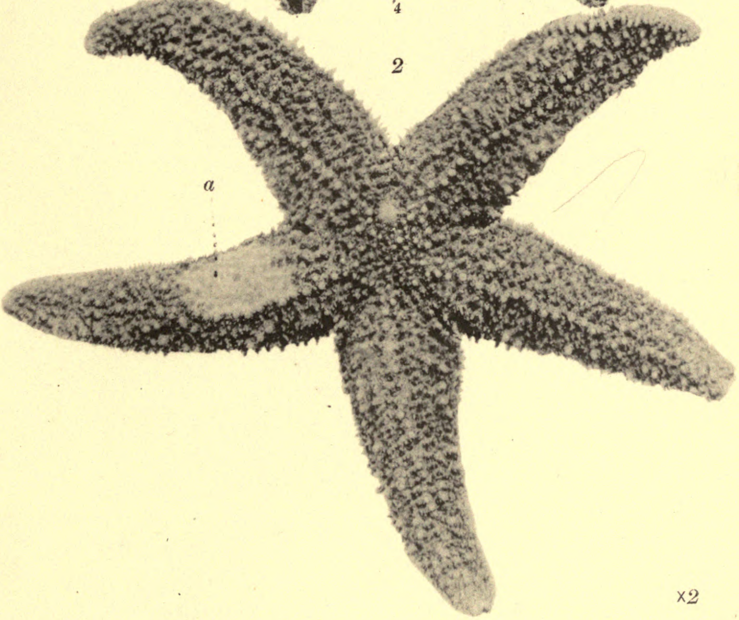
FIG. 2. *Leptasterias inequalis* Verrill. Type. Dorsal side; *a,* ossicles, with spines removed; × 2.

Asterias ? amurensis juv.

1



2



HELIOTYPE CO., BOSTON

1. Pycnopodia helianthoides (Br.) Young
2. Leptasterias inequalis Ver. Type

74

74

PLATE LXXIV.

FIG. 1. *Pycnopodia helianthoides.* Very young, with nine rays; 1, odd anterior primary ray; 2, 2′, first pair of interpolated rays; 3, small budding ray of second pair; 3′, position in which the mate to No. 3 should appear, but no rudiment of it is visible externally; *a*, odd posterior primary ray; *b, b′* and *c, c′*, second and third pairs of posterior primary rays; × 3⅜. From Dutch Harbor, Alaska.

FIG. 2. The same. A somewhat larger specimen with ten rays, in normal order; × 3⅜. Lettering as in fig. 1. From Kadiak.

FIG. 3. The same. A somewhat larger, abnormal, oblong young specimen with eighteen rays, not all in regular order (see page 200); *m*, madreporic plate of abnormal size; × 2⅗. Lettering of rays as in fig. 2, with the addition of pairs 4 and 5 anteriorly, and *d, d′* and *e, e′* posteriorly. The last two pairs are abnormal; *c* is an abnormal budding ray. From Kadiak, Alaska.

FIG. 3*a*. The same specimen. Actinal side; × 3. Lettering as in fig. 3.

FIG. 4. *Stenasterias macropora* Verrill. Type. Portion of the actinal side with the spines removed; × 3.

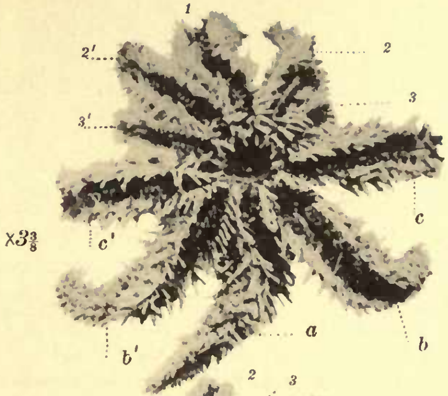
FIG. 5. *Leptychaster pacificus* Fisher. Dorsal view; × about 2.

FIG. 6. *Pycnopodia helianthoides* (Brandt). Minor pedicellariæ; *a, b, c*, side and profile views; × 165.

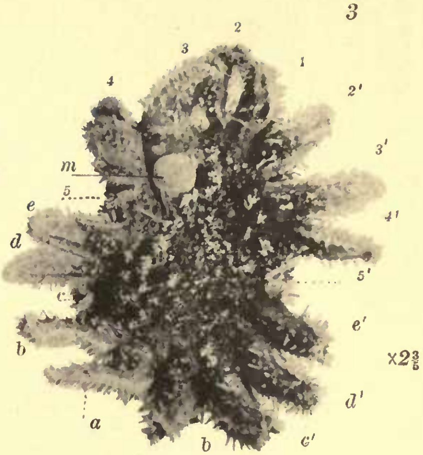
print this
portion.

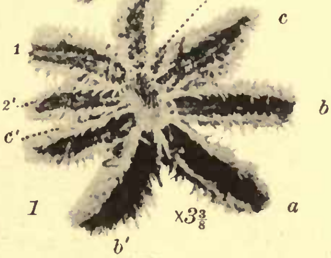
74

2

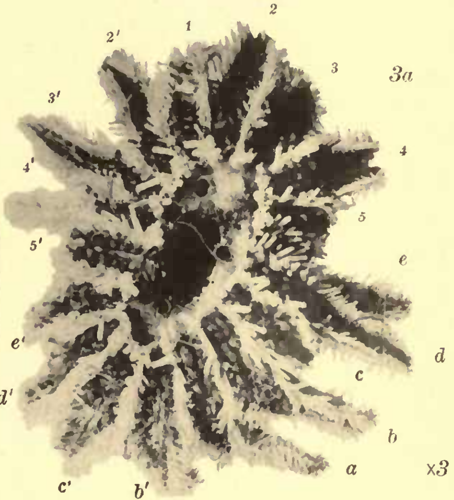


3

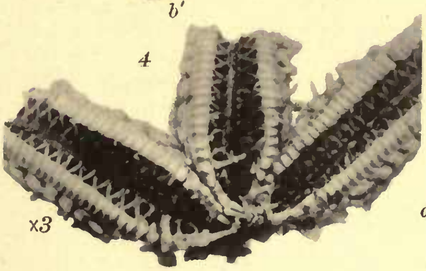




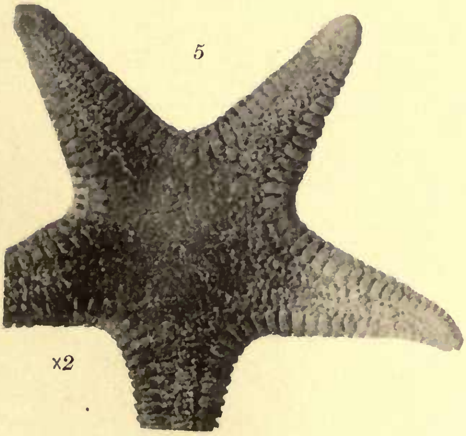
3a



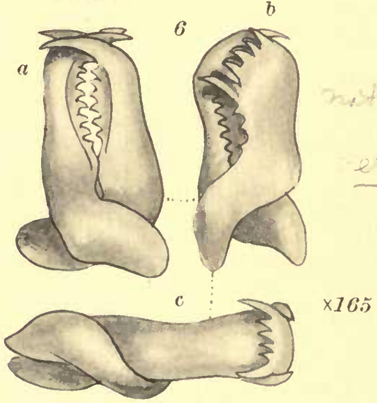
4



5



6



not at all
error !

HELIOTYPE CO., BOSTON

1-3a. Pycnopodia helianthoides (Br.) Young
4. Stenasterias macropora Ver.
5. Leptychaster pacificus Fisher
6. P. helianthoides (Br.)

75—

75

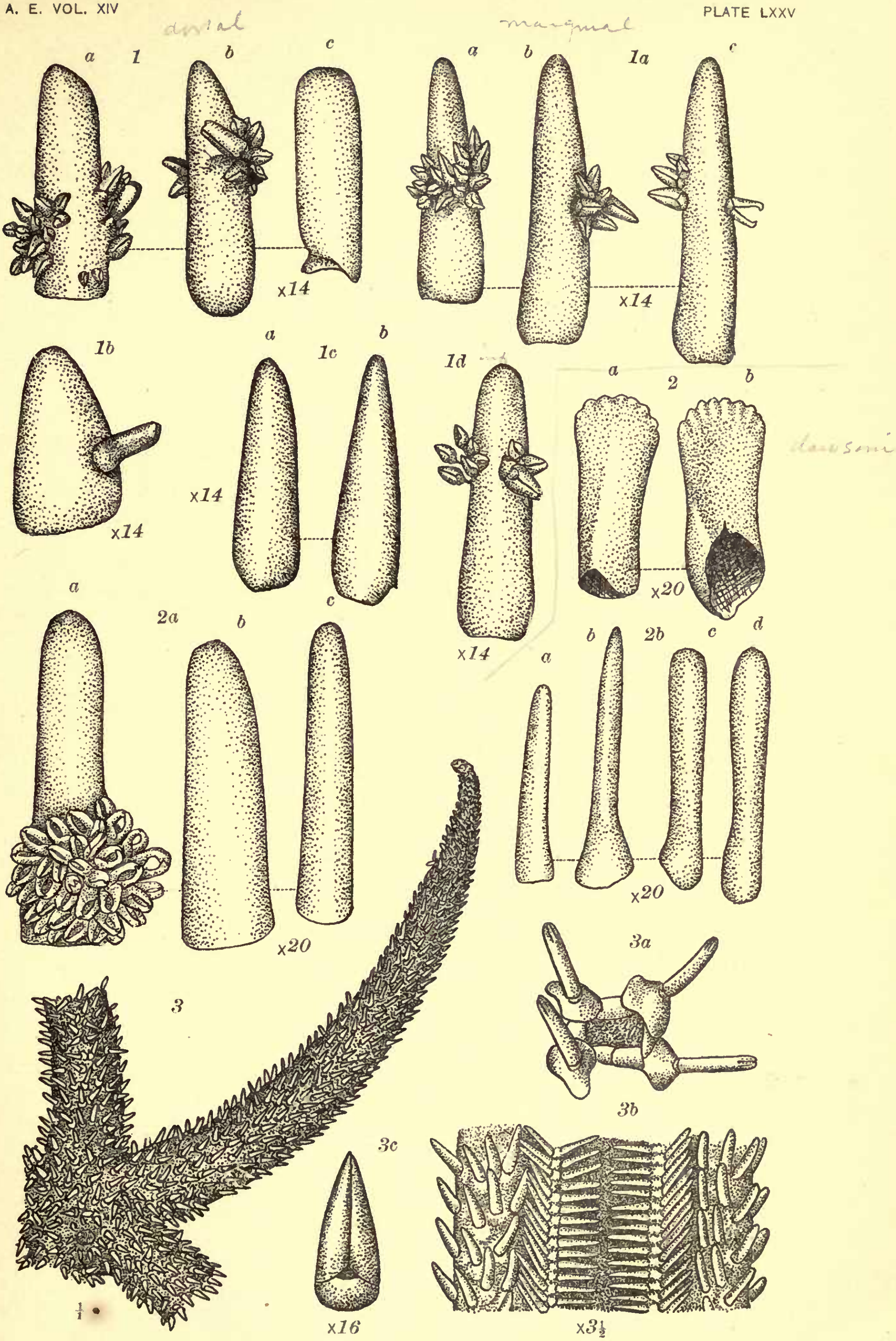
PLATE LXXV.

achermae

FIGS. 1-1*d*. *Orthasterias merriami* Verrill. Spines and pedicellariæ from No. 1181; 1, *a, b, c,* and 1*c,* ordinary dorsal spines; 1*a, a, b, c,* marginal spines; 1*c,* adambulacral spines; 1*b,* a stout dorsal with a major pedicellaria attached; 1*d,* inferomarginal; × 14; No. 1181, Mus. Comp. Zoöl.

FIGS. 2–2*b*. *Orthasterias dawsoni* Verrill. Type. Spines and pedicellariæ, × 20; 2, *a, b,* large valves of major pedicellariæ; 2*a,* dorsal spines; *a,* with wreath of minor pedicellariæ; *b, c,* pedicellariæ removed; 2*b,* adambulacral spines; *a, b,* from inner row; *c, d,* from outer row.

FIGS. 3-3*c*. *Orthasterias koehleri* (de Loriol) Verrill. Type. After de Loriol; 3, part of dorsal side, about natural size; 3*a,* four dorsal ossicles and spines; 3*b,* portion of actinal side, × 3½; 3*c,* a major pedicellaria; × 16.



A. HYATT VERRILL DEL.
HELIOTYPE CO., BOSTON

1-1d. Asterias katherinae Gray ok
2-2b. O. dawsoni Ver. Type
3-3c. O. koehleri (Lor.) Type

76

76

PLATE LXXVI.

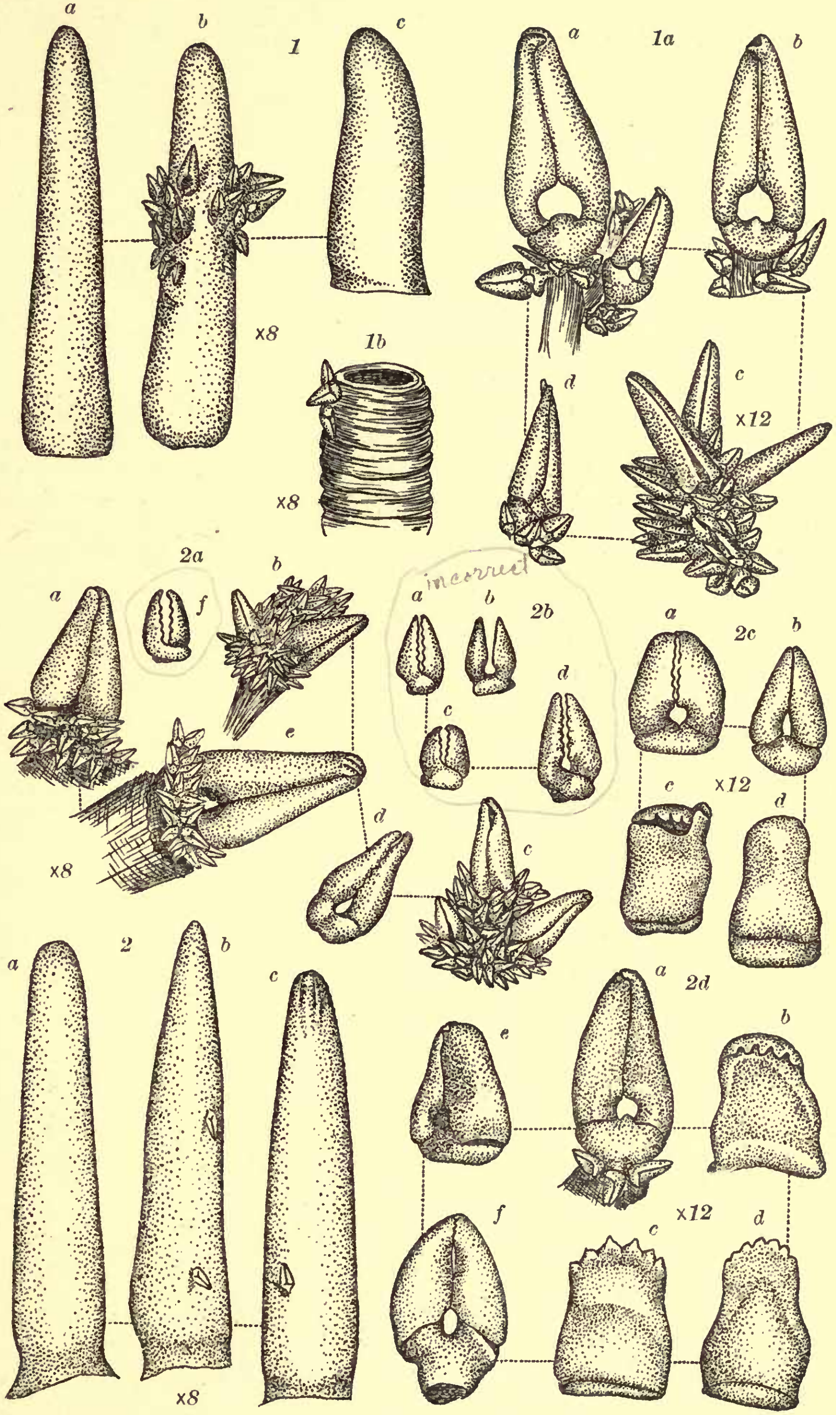
…imen is labeled
…ster papulosus - Ver
? not typ.

FIGS. 1–1*b*. *Pisaster brevispinus* (Stimpson). Spines and pedicellariæ of No. 1301, Mus. Comp. Zoöl., Gulf of Georgia, × 8; *a, b, c,* dorsal spines; 1*a, b, c,* pedicelled clusters of adambulacral pedicellariæ, from inner edge and within the groove, consisting of both major and minor kinds, of various sizes, attached to a common pedicel; 1*b,* tip of a sucker-foot with pedicellariæ attached.

FIGS. 2–2*d*. *Pisaster papulosus* Verrill. Type. 2, *a, b, c,* marginal spines; 2*a, a-e,* clusters of adambulacral or furrow pedicellariæ attached to a common pedicel and containing both sorts; *f,* a minor pedicellaria much enlarged; 2*b, a-d,* minor pedicellariæ more enlarged; 2*c, a-d;* and 2*d, b-f,* dorsal and lateral large dermal major pedicellariæ of several forms; 2*d, a,* is an adambulacral group.

micro…

76



A. HYATT VERRILL DEL.

HELIOTYPE CO., BOSTON

1-1b. Pisaster papulosus Ver. Var.
2-2d. P. papulosus Ver. Type

77

77

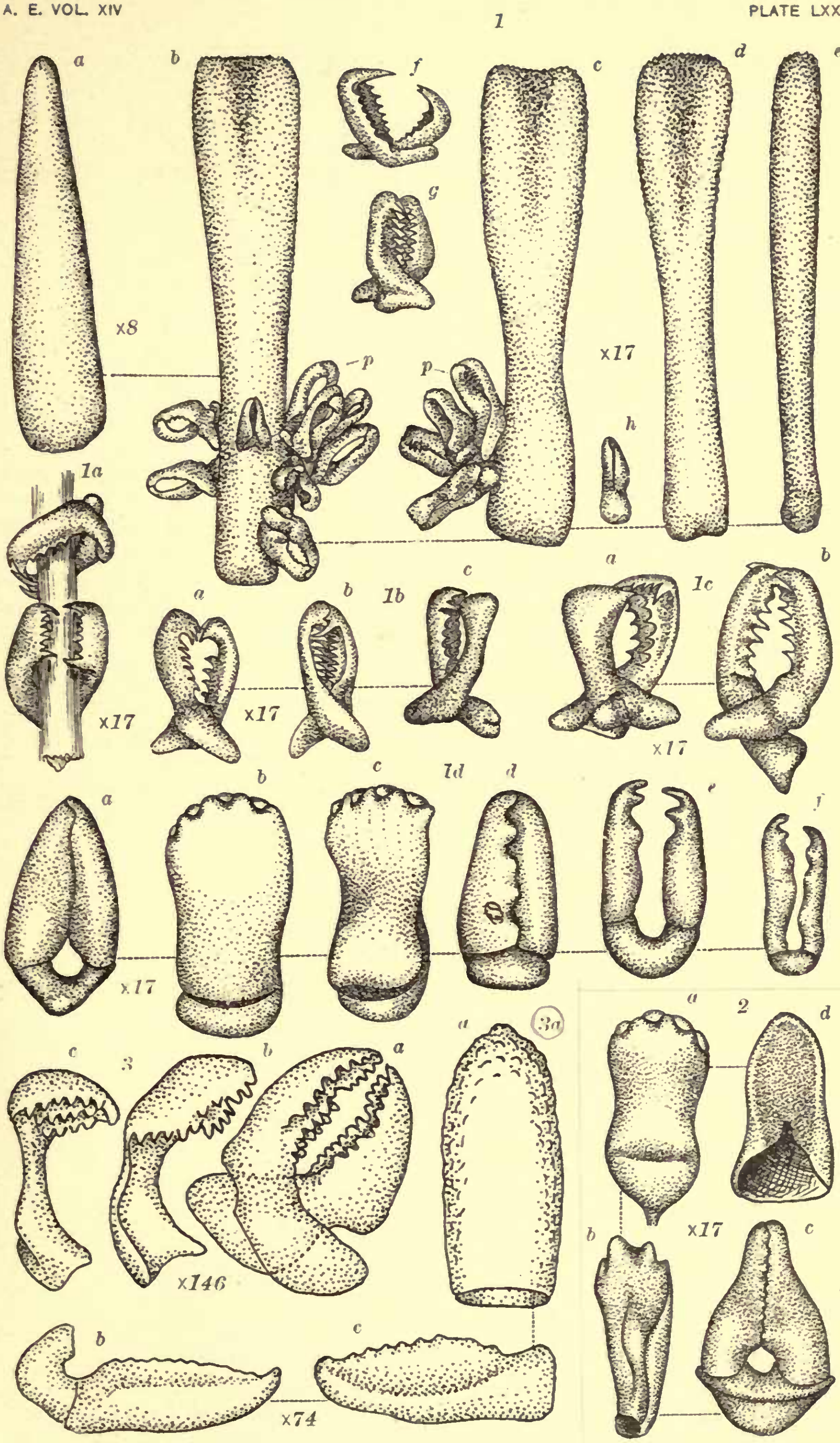
PLATE LXXVII.

Figs. 1–1*d*. *Orthasterias forreri* (Loriol) Verrill. Spines and pedicellariæ; 1, *a*, dorsal spine with pedicellariæ removed, × 8; 1, *b*, lower marginal; *c*, upper marginal; *d*, outer adambulacral; *e*, inner adambulacral spine; × 17; *f*, *g*, *h*, some of the detached minor pedicellariæ; 1*a*, two of the minor pedicellariæ grasping a fiber of hemp from the tangles; 1*b*, 1*c*, dermal minor pedicellariæ from the dorsal side, × 17; 1*d*, *a-f*, dermal major pedicellariæ from dorsal and lateral areas.

Fig. 2. *Orthasterias leptolena* Verrill. Type. Major pedicellariæ; *a-d*, four varieties from the dorsal and lateral areas; × 17.

Fig. 3. *Allasterias forficulosa* Verrill. Minor pedicellariæ; *a*, with valves united; *b*, *c*, detached valves; × 146.

Fig. 3*a*. The same; *a*, *b*, *c*, detached valves of major pedicellariæ; × 74.



leptolena

A. HYATT VERRILL DEL. HELIOTYPE CO., BOSTON

1-1d Orthasterias (Stylasterias) forreri (Lor.)
2. O. leptolena Ver. Type
3-3a. Allasterias anomala Ver. Type

78

78

PLATE LXXVIII.

FIG. 1. *Orthasterias columbiana* Verrill. Cotype. A dorsal spine and minor pedicellariæ from the largest specimen from Victoria; × 13. Prov. Mus. British Columbia.

FIG. 1*a*. The same. Type. *a-i,* large dermal major pedicellariæ from the dorsal and lateral areas; × 11.

FIG. 1*b*. The same. Type. *a-d,* minor pedicellariæ; × 48.

FIG. 1*c*. The same. A pedicelled adambulacral major pedicellaria; × 17.

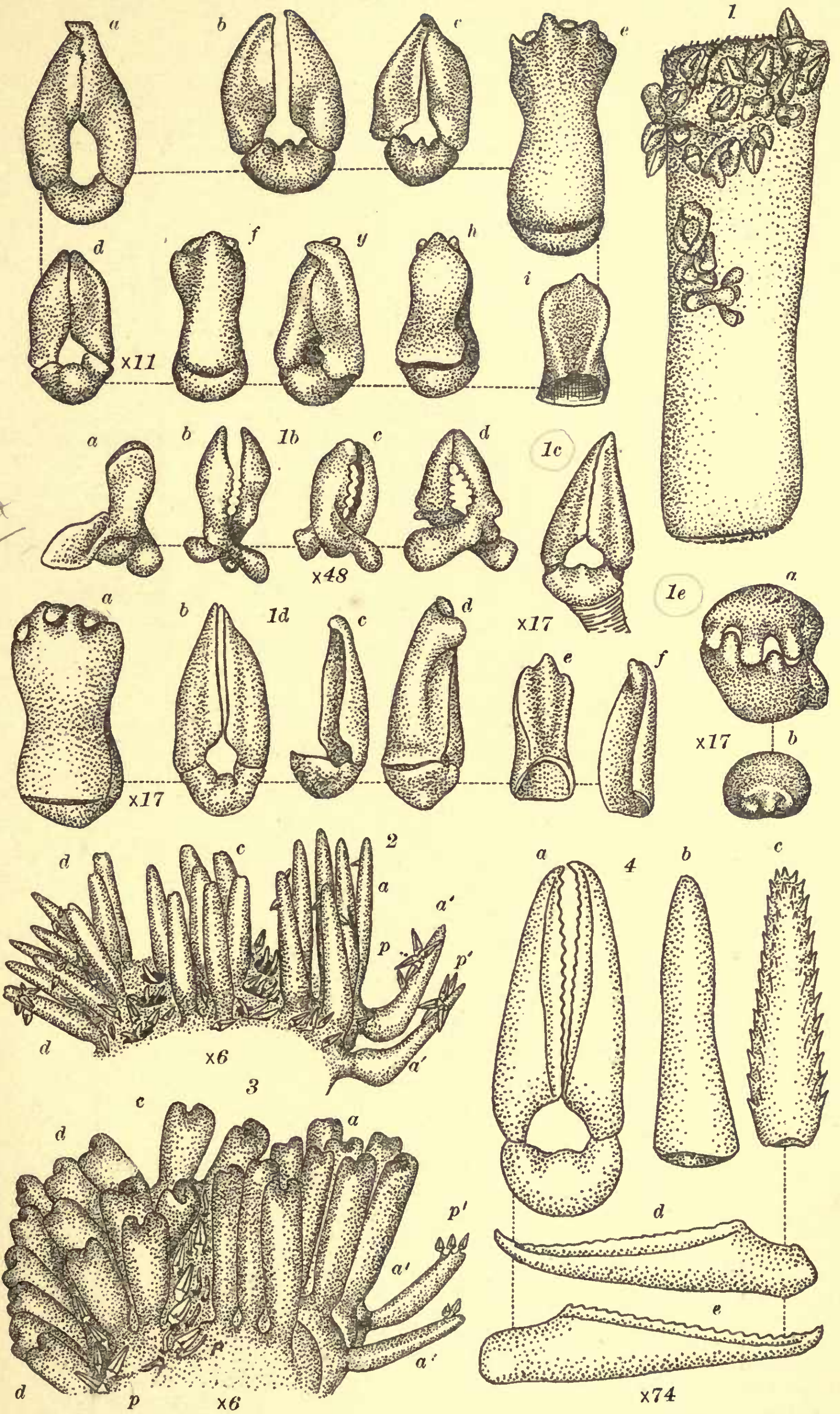
FIG. 1*d*. The same. Type. *a-f,* major pedicellariæ from the dorsal and lateral areas; × 17.

FIG. 1*e*. The same. End views of two of the larger major pedicellariæ; × 17.

FIG. 2. *Allasterias rathbuni nortonensis* Verrill. Adambulacral (*a*); peractinal (*c*); and inferomarginal (*d, d*) groups of spines; *a′, a′,* inner or furrow-spines on alternate plates; *p, p,* papulæ and dermal pedicellariæ; *p′, p′,* adambulacral pedicellariæ; × 6.

FIG. 3. *Allasterias anomala* Verrill. Type. × 6. Lettering as in fig. 2.

FIG. 4. The same. Major pedicellariæ (*a*) and detached valves (*c-e*); × 74.



1a

1b incorrect

1d

2

donensis

3

mala

incorrect

incorrect

A. HYATT VERRILL DEL.

HELIOTYPE CO., BOSTON

1-1e. ORTHASTERIAS COLUMBIANA VER. Cotype
2. ALLASTERIAS RATHBUNI NORTONENSIS VER.
3-4. A. ANOMALA VER. Type

79

79

PLATE LXXIX.

FIG. 1. *Asterias polythela* Verrill. Type. Detached valves of minor pedicellariæ mounted in balsam; *a-d;* × 88.

FIG. 2. The same specimen. Spines and pedicellariæ; *a, b,* adambulacral spines; *c,* a marginal spine with pedicellariæ removed; × 10.

FIG. 2*a*. The same specimen. *a-d,* larger and smaller dorsal spines; × 16.

FIG. 3. *Orthasterias columbiana* Verrill. Largest specimen from Victoria. Cotype. Spines, with pedicellariæ and skin removed; *a, b,* outer adambulacrals; *c,* inner one; × 10.

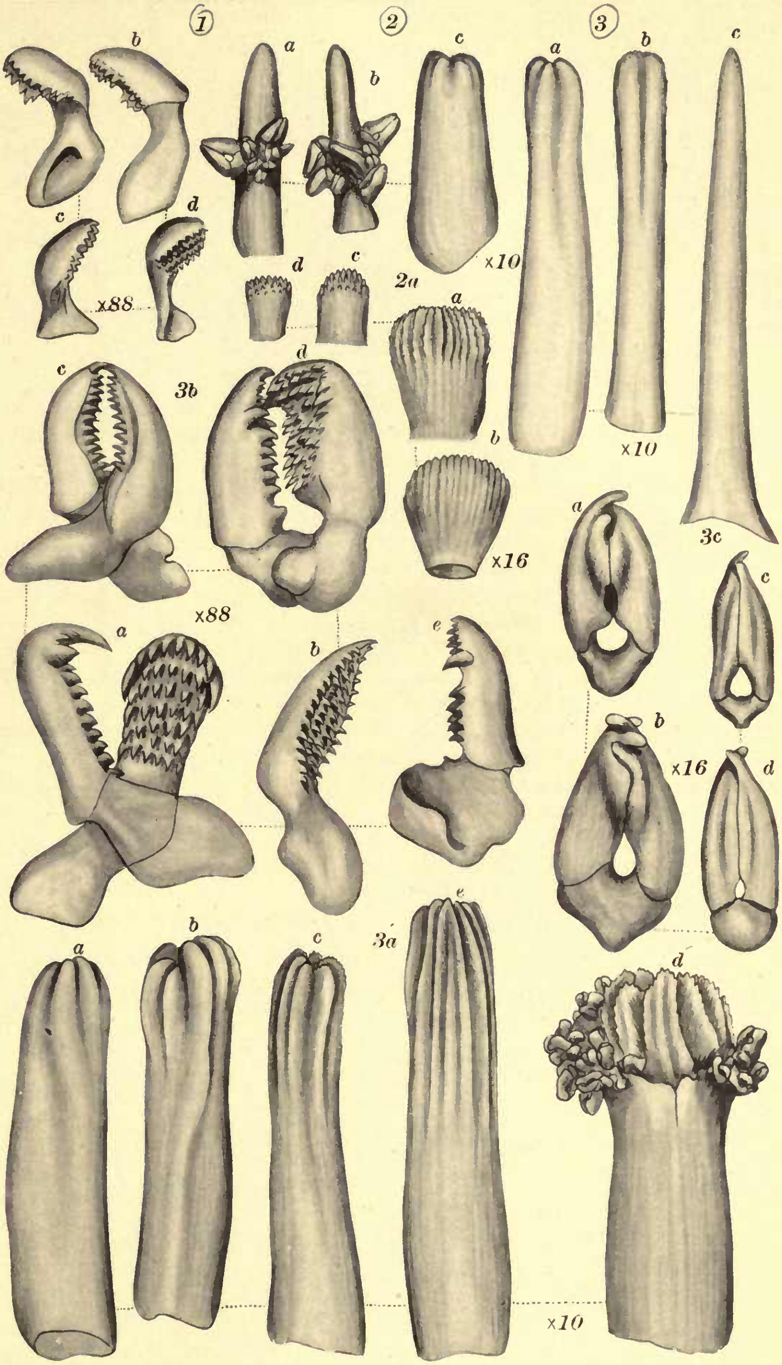
FIG. 3*a*. The same specimen. Spines cleaned of skin and pedicellariæ except *d; a, b,* dorsals; *c,* upper marginal; *d,* dorsal covered with a sheath bearing pedicellariæ near the tip; × 10.

FIG. 3*b*. The same specimen. Minor pedicellariæ mounted in balsam; *c, d,* entire; *a, b, e,* dislocated valves; × 88.

FIG. 3*c*. The same specimen. Dermal major pedicellariæ from the dorsal and lateral areas; × 16.

incorrect

O. columbiana



A. HYATT VERRILL DEL.
HELIOTYPE CO., BOSTON

1-2a ASTERIAS POLYTHELA VER. Type
3-3c ORTHASTERIAS COLUMBIANA VER.

80

80

PLATE LXXX.

FIG. 1. *Orthasterias forreri* (de Loriol) Verrill. Minor pedicellariæ, *a, b, c, d,* mounted in balsam; × 25.

FIGS. 1*a*, 1*a'*. The same specimen. Two large dorsal dermal major pedicellariæ; × 10.

FIG. 1*b*. The same specimen. *a-d,* four detached valves of minor pedicellariæ, mounted in balsam; × 45.

FIG. 1*c*. The same specimen. A cleaned dorsal spine; × 5.

FIGS. 1*d*, 1*e*. The same. Dorsal plates; × 5. 1*d*, dorso-lateral with a spine; 1*e*, carinal seen from inner side; *c,* connective ossicle; *d, d',* facets for articulation of transverse connective ossicles.

FIG. 2. *Orthasterias dawsoni* Verrill. Type. *a-f,* disarticulated valves of minor pedicellariæ mounted in balsam; *g,* one entire; × 83.

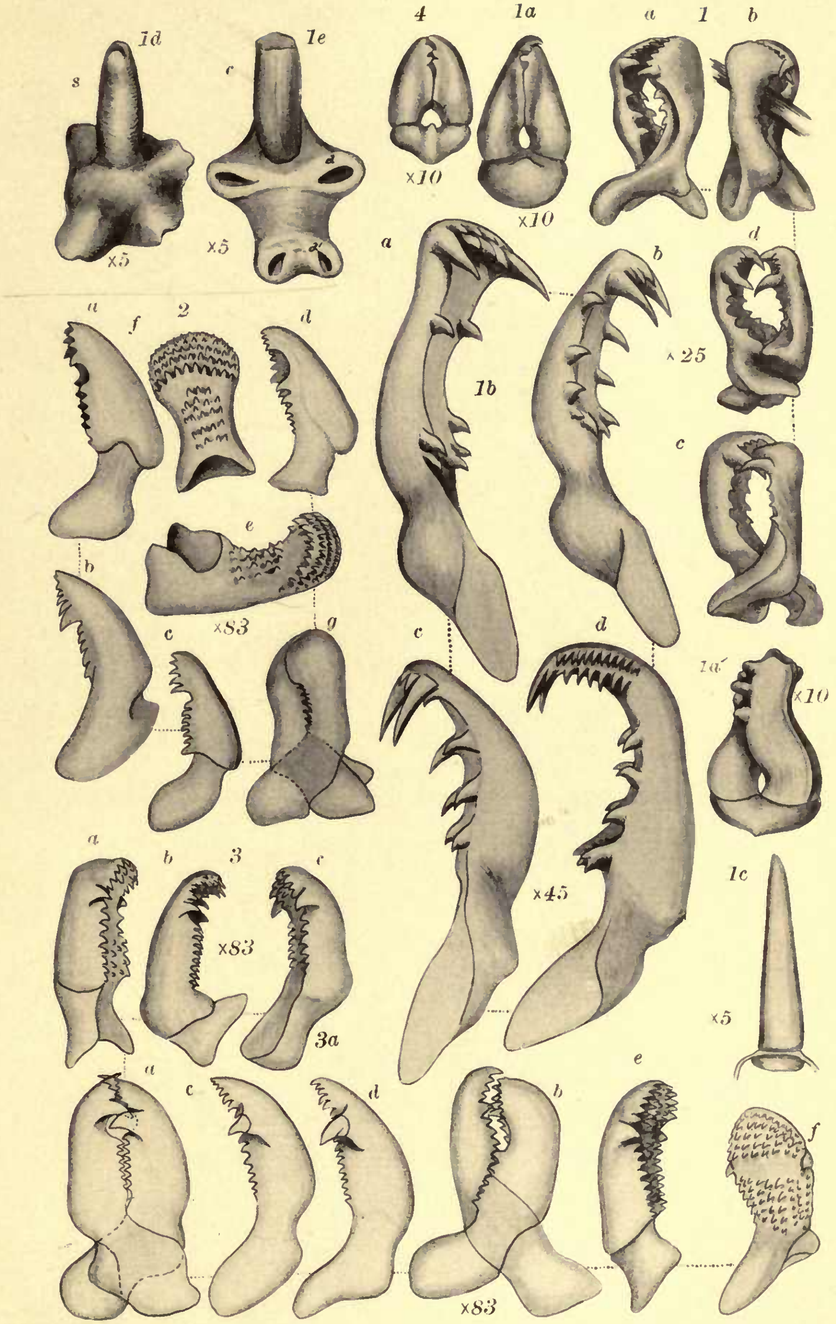
gonolena
group

FIGS. 3, 3*a*. *Orthasterias californica* Verrill. Type. Minor pedicellariæ mounted in balsam; 3*a*, *a, b,* are entire; the rest, *c, f,* are disarticulated valves; × 83.

FIG. 4. *Pisaster papulosus* Verrill. Type. Major pedicellaria; × 10.

80

papulosus



wsoni

alif.

Calif.

Calif

A. HYATT VERRILL DEL.

HELIOTYPE CO., BOSTON

1-1e. Orthasterias forreri (Lor.) ~~Type~~
2. O. dawsoni Ver. Type
3-3a. O. californica Ver. Type
4 Pisaster papulosis Ver. Type

81

81

PLATE LXXXI.

FIG. 1. *Distolasterias chelifera* Verrill. Type. Dermal major pedicellariæ; *a, b, c, d,* are elongate, strongly unguiculate forms; *e* is a stouter form, and not unguiculate; × 28. No. 1346, Mus. Comp. Zoöl.

FIG. 1*a*. The same specimen. One of the dorsal spines bearing a wreath of minor pedicellariæ, *P, P;* × 8.

FIG. 1*b*. The same specimen. Spines cleaned; *a*, marginal spine with pedicellariæ removed; *b*, outer adambulacral; *c*, inner adambulacral; *e, f,* adambulacral major pedicellariæ; × 28.

FIG. 2. *Orthasterias californica* Verrill. Type. *a*, an inferomarginal spine, cleaned; *b*, a dorsal spine with a wreath of minor pedicellariæ; × 12.

FIG. 2*a*. The same specimen. *a*, outer; *b*, inner adambulacral spine; × 12.

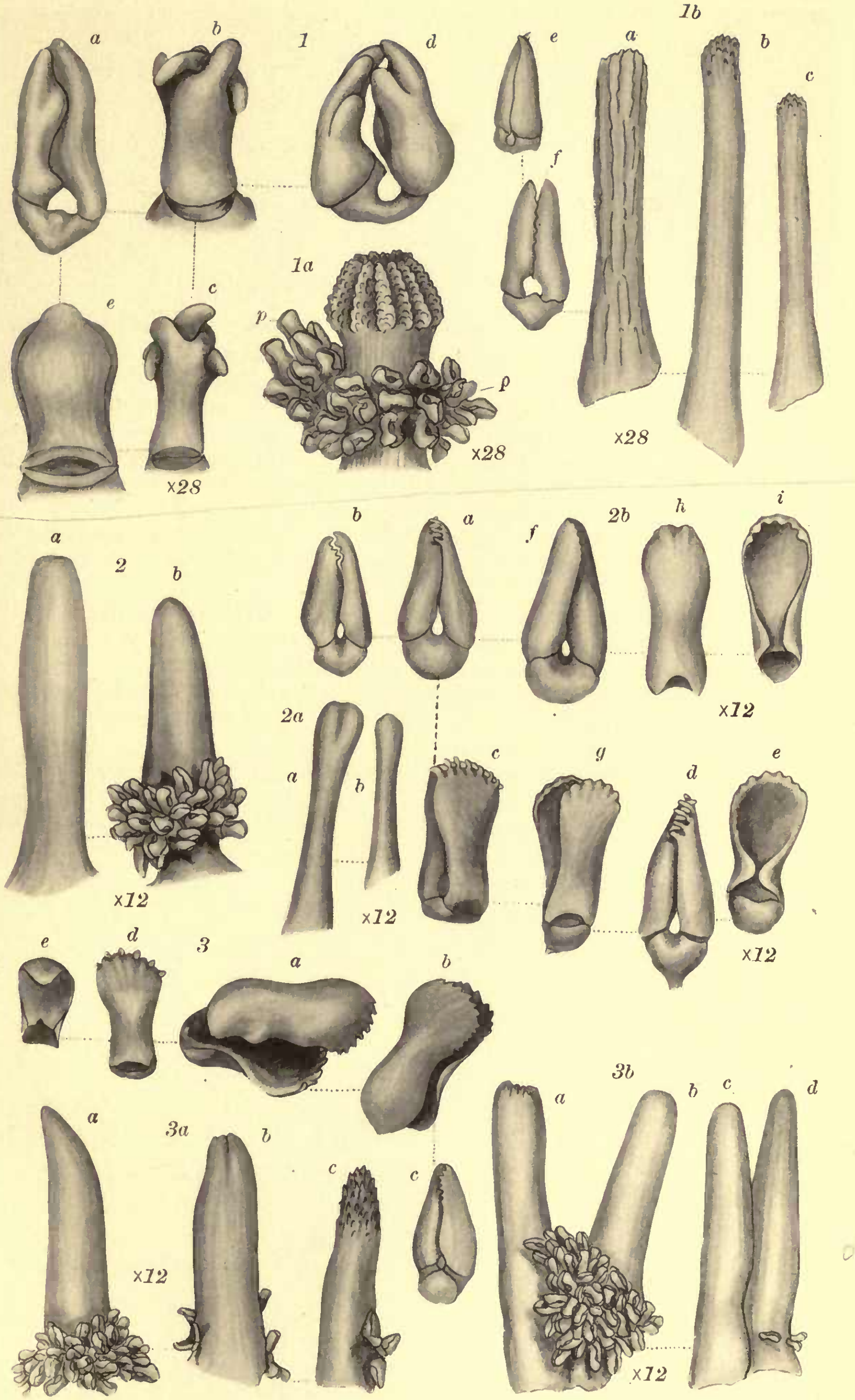
FIG. 2*b*. The same specimen. Major pedicellariæ; *a, b, c, d, e,* dorsal; *f, g,* adambulacral; *h, i,* actinal interradial; × 12.

FIG. 3. *Orthasterias dawsoni* Verrill. Type. Dermal major pedicellariæ; *a, b,* stout dorsal form; *c, d, e,* more slender spatulate or plataleiform sorts from the lateral area; × 12.

FIG. 3*a*. The same specimen. Spines; *a, b, c,* dorsal spines treated with Javelle water to remove most of the pedicellariæ; × 12.

FIG. 3*b*. The same specimen. Inferomarginal spines; *a, b,* a pair with pedicellariæ; *c, d,* a smaller pair cleaned with Javelle water; × 12.

chelif



Calif.

Calif.

dawsoni

A. HYATT VERRILL DEL.
HELIOTYPE CO., BOSTON

1-1b. Distolasterias chelifera Ver. Type
2-2b. Orthasterias californica Ver. Type
3-3b, O. dawsoni Ver. Type

82

82

PLATE LXXXII.

FIG. 1. *Asterias victoriana* Verrill. Type. *a, b,* adambulacral spines with epispinal clusters, *p, p,* of pedicellariæ of both sorts; × 18.

FIG. 1*a*. The same specimen. Dorsal spines; *a,* one of the larger, and *b,* one of the smaller sorts; *P,* minor pedicellariæ; × 18.

FIG. 1*b*. The same specimen. An inferomarginal spine and minor pedicellariæ; × 18.

FIG. 1*c*. The same specimen. *a, b,* two of the major pedicellariæ; × 25.

FIG. 2. *Orthasterias biordinata* Verrill. Type. Group of spines of the actinal side; *a′,* inner, and *a,* outer adambulacrals; *b,* peractinals; *c, d,* inferomarginals; × 5½.

FIG. 2*a*. The same specimen. *a,* dorsal spine; *b,* adambulacral spine; × 12.

FIG. 2*b*. The same specimen. Dorsal dermal major pedicellariæ, front and profile views; × 12.

FIG. 3. *Orthasterias gonolena* Verrill. Spines cleaned with Javelle water; *a, b,* outer adambulacrals; *c,* marginal; × 18. No. 1825, Mus. Comp. Zoöl.

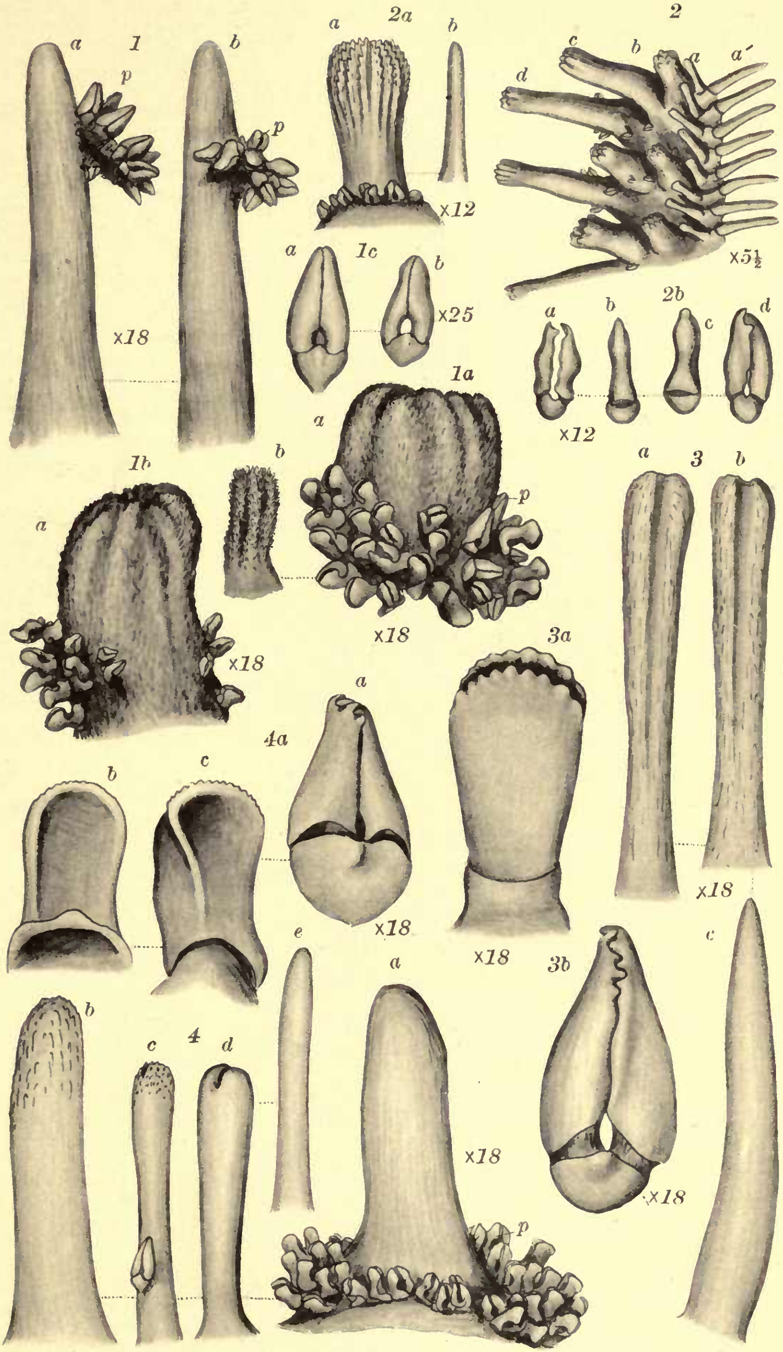
FIG. 3*a*. The same specimen. A large denticulate dermal major pedicellaria from the lateral or intermarginal area; × 18.

FIG. 3*b*. The same specimen. Major pedicellaria from the outer adambulacral spines; × 18.

FIG. 4. The same specimen (No. 1825). Spines; *a,* one of the dorsal spines with a basal wreath of minor pedicellariæ; *b,* inferomarginal, cleaned; *c, d,* outer adambulacrals; *e,* inner adambulacral; × 18.

FIG. 4*a*. The same; *a, b, c,* major pedicellariæ; details; × 18.

82



O.
2b. biordinata

3
gonolena

A. HYATT VERRILL DEL.

HELIOTYPE CO., BOSTON

1-1c. Asterias victoriana Ver. Type
2-2b. Orthasterias biordinata Ver. Type
3-3b., 4., 4a. O. gonolena Ver.

83

83

PLATE LXXXIII.

FIG. 1. *Asterias katherinæ* Gray. Spines with pedicellariæ; *a,* adoral adambulacral; *b,* inner adambulacral; *c, d,* outer adambulacral; *e, f,* peractinals; *g, h,* inferomarginals; × 11.

FIG. 2. *Leptasterias arctica* (Murdoch). Spines and major pedicellariæ; *a,* adambulacral spine; *b, c,* adambulacral major pedicellariæ; *d,* axillary or interradial one; *e,* unguiculate marginal one; × 25.

FIG. 2*a.* The same specimen. Finer spined variety. Portion of the dorsal surface showing spines, *c, d, d′;* papulæ, *a, a;* minor pedicellariæ, *f, f;* papular pores, *a′;* × 11.

FIG. 3. *Allasterias forficulosa* Verrill. Type. Portion of the dorsal surface, showing spines, *c, d;* papulæ, *a, a;* papular pores, *a′;* dermal major pedicellariæ, *e, e;* circumspinal minor pedicellariæ, *f, f;* dermal minor pedicellariæ, *f′ f′;* × 11. Japan. No. 1183. Mus. Comp. Zoöl.

FIG. 3*a.* The same specimen. Adambulacral spines, *a, b, c,* and attached major pedicellariæ, *P, P; d,* one of the same, detached; × 16.

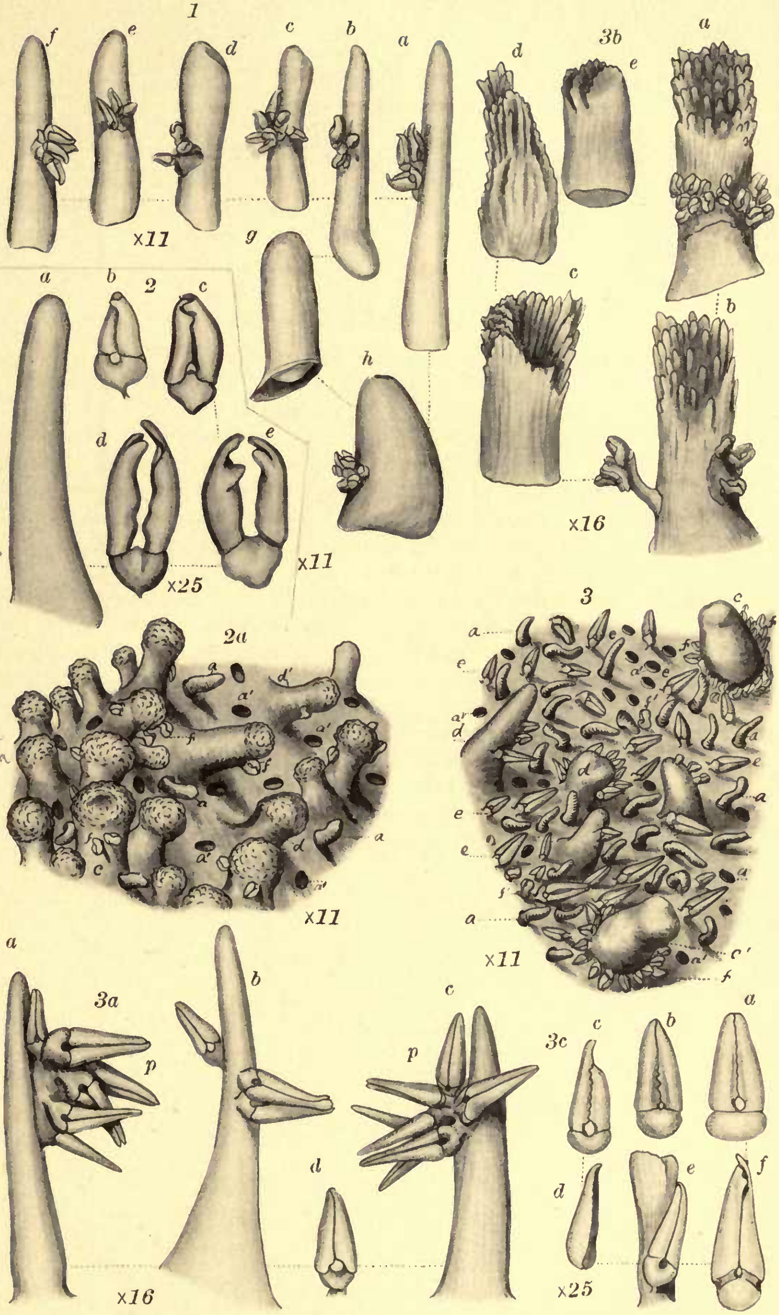
FIG. 3*b.* The same specimen. *a-e,* marginal spines; × 16.

FIG. 3*c.* The same specimen. Major pedicellariæ; *a, b, c, d,* dorsal dermal; *e,* marginal; *f,* axillary; × 25.

83

arctica

arctica



A. HYATT VERRILL DEL.

HELIOTYPE CO., BOSTON

1. Asterias katherinae Gray
2-2a. Leptasterias arctica (Mur.)
3-3c. Allasterias forficulosa Ver. Type

84

84

PLATE LXXXIV.

Fig. 1. *Allasterias forficulosa* Verrill. Type. Minor pedicellariæ mounted in balsam; *a, b, c,* entire; *d-h,* detached valves; × 88. Japan. No. 1183, Mus. Comp. Zoöl.

Fig. 2. *Asterias multiclava* Verrill. Type. Minor pedicellariæ in balsam; *a,* entire; *b-c,* separated valves; × 88.

Fig. 2*a*. The same specimen. Dermal dorsal major pedicellariæ; *a, b,* separated valves; × 88.

Fig. 3. *Asterias polythela* Verrill. Type. Adambulacral spines and pedicellariæ; × 10.

Fig. 4. The same specimen. Spines with adhering pedicellariæ; *a, b, c,* dorsals; *d, e,* adambulacrals with major pedicellariæ; × 16.

Fig. 5. *Stenasterias macropora* Verrill. Type. *a-g,* dorsal spines, mostly from bases of rays; × 16.

Fig. 5*a*. The same specimen. Adambulacral spines, *a-d;* × 16.

Fig. 5*b*. The same specimen. *a,* adoral spine with pedicellariæ; *c, d, e,* marginal spines, × 16; *b,* oral pedicellariæ, × 50.

Fig. 5*c*. The same. Group of ossicles of actinal side; *ad,* adambulacrals; *i,* peractinals; *im,* inferomarginals; *sm,* supramarginals; × 10.

Fig. 5*d*. The same. Adoral adambulacral plates (*ad*), and spine with pedicellariæ (*p*).

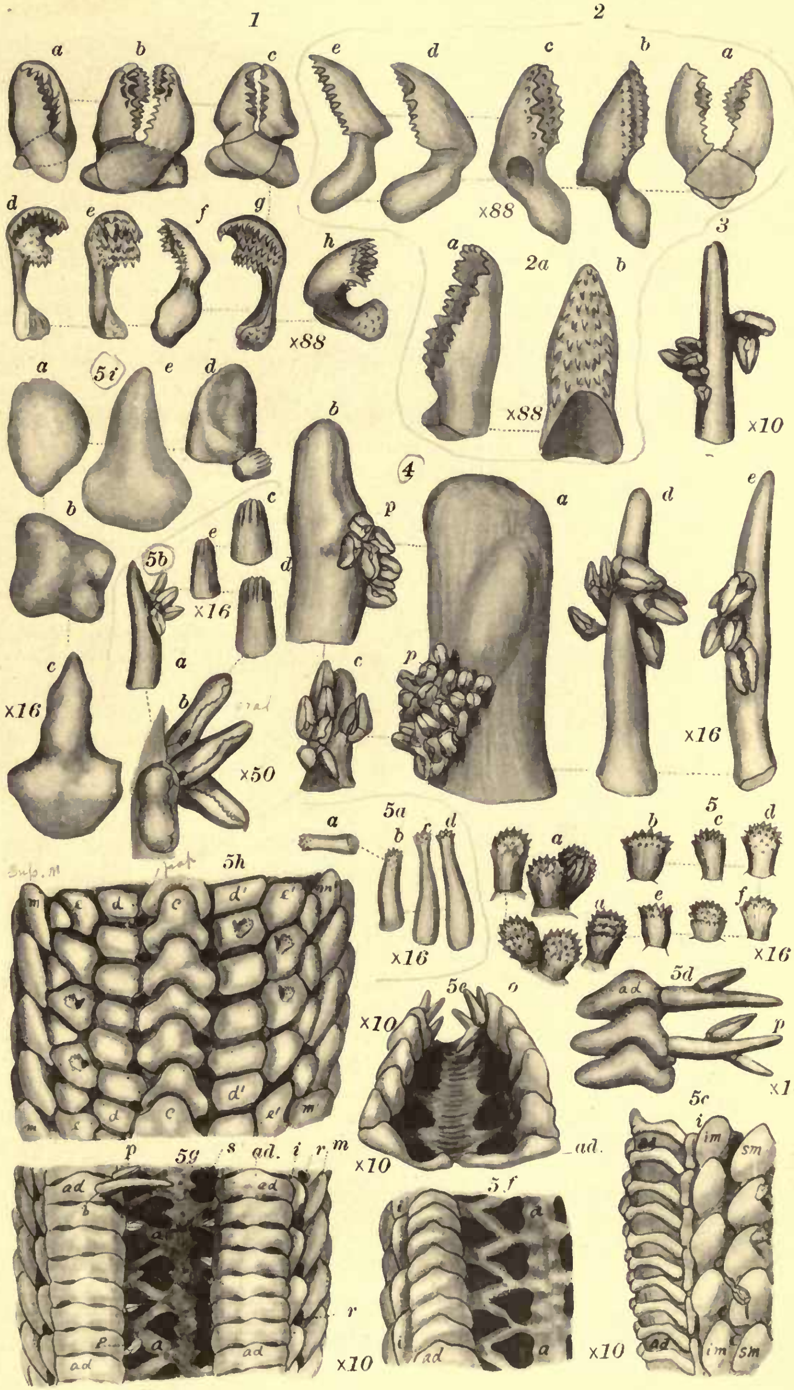
Fig. 5*e*. The same. Adoral portion of the groove, with large pores of sucker-feet; *ad,* adambulacral plates; *o,* oral spines; × 10.

Fig. 5*f*. Portion of groove and plates from middle of ray; *a, a,* ambulacral plates and large pores; *ad,* adambulacral plates; *i,* peractinals; × 10.

Fig. 5*g*. The same. Segment of actinal side of a ray deprived of spines; *a, a,* ambulacral plates and large sucker pores (*s*); *a, d,* adambulacral plates; *i,* peractinals; *m,* inferomarginal; *b,* a remaining adambulacral spine; *p, p,* adambulacral pedicellariæ; *r, r,* papular pores; × 10.

Fig. 5*h*. The same. Dorsal side of ray, with spines removed; *c, c,* median or carinal row of plates; *d, d,* and *d′ d′,* right and left secondary rows of plates; *e, e′,* second pair of secondary rows of plates; *m, m′,* superomarginal rows; single papular pores lie between the plates in rows; × 10.

Fig. 5*i*. The same. Skeletal ossicles; *a,* peractinal plate; *b,* superomarginal; *c,* inferomarginal; *d,* adambulacral; *e,* superomarginal; × 16.



multiclava

polythela

5i

polythela

A. HYATT VERRILL DEL.

HELIOTYPE CO., BOSTON

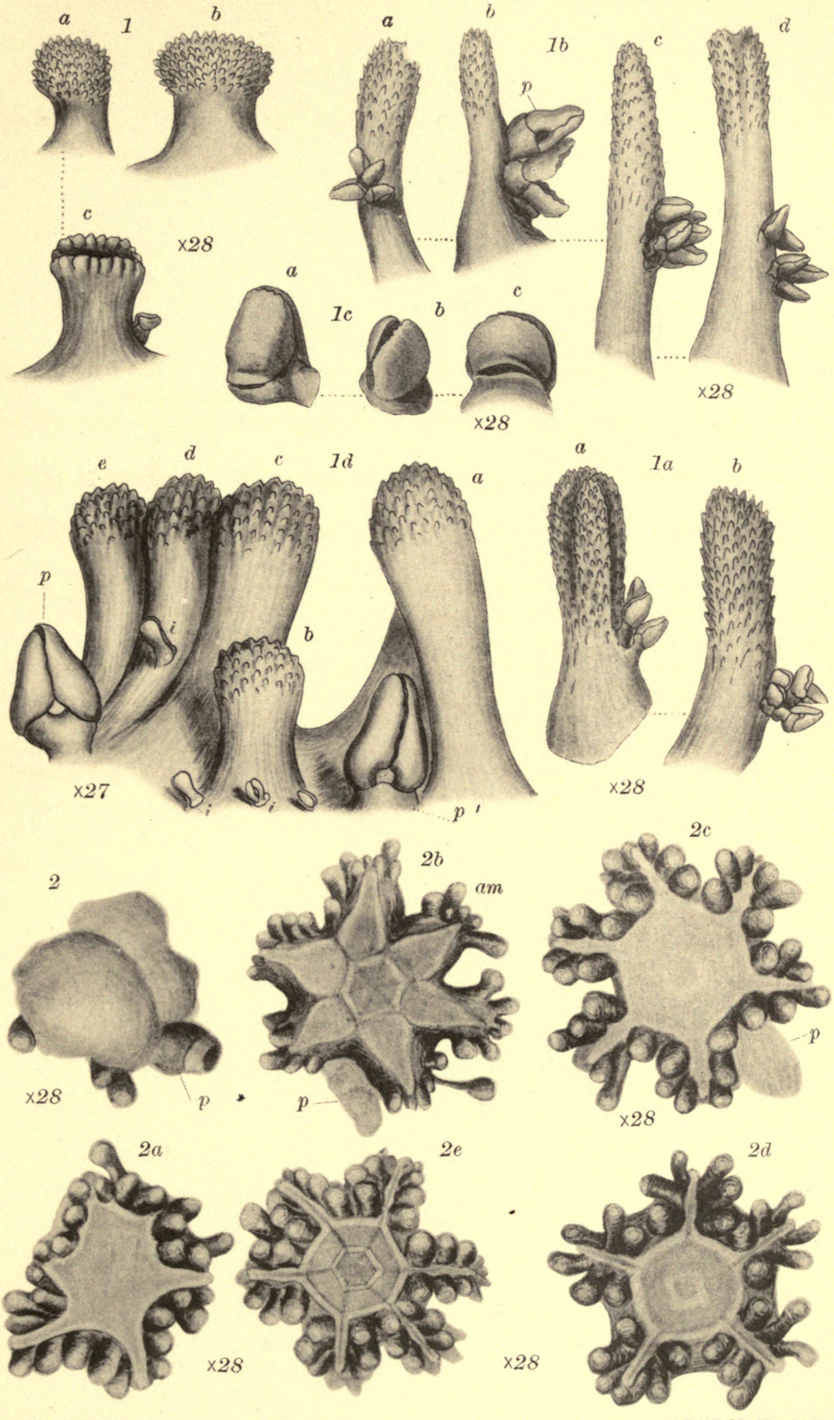
1. Allasterias forficulosa Ver. Type
2-2a. Asterias multiclava Ver. Type
3. 4. A. polythela Ver. Type
5-5i. Stenasterias macropora Ver. Type

85—

85

PLATE LXXXV.

FIG. 1.	*Leptasterias epichlora alaskensis* Verrill. Type. Dorsal spines, *a, b, c, of* different sorts; × 28. Dutch Harbor.
FIG. 1*a*.	The same specimen; *a,* inferomarginal spine; *b,* superomarginal; × 28.
FIG. 1*b*.	The same specimen; *a, b, c,* adambulacral spines; *d,* peractinal; × 28.
FIG. 1*c*.	The same specimen; *a, b, c,* large, erect, intermarginal major pedicellariæ; × 28.
FIG. 1*d*.	The same specimen; marginal spines and pedicellariæ; *a,* superomarginal spines; *b, c, d, e,* inferomarginals; *p, p′,* major pedicellariæ; *i, i′,* minor pedicellariæ.
FIGS. 2-2*e*.	The same. Young carried by parent, in different stages of growth; *a, b,* younger stages; *p,* pedicel for attachment; *a, m,* podia or ambulacral feet; × 28. In 2, the form is irregular, with few podia; in 2*a,* the form has become stellate, but with unequal rays. Later stages are regularly stellate; 2*d* is five-rayed; the others are six-rayed like the parent.



A. HYATT VERRILL DEL. HELIOTYPE CO., BOSTON

LEPTASTERIAS EPICHLORA ALASKENSIS VER. Type,
AND YOUNG OF THE SAME

86

86

PLATE LXXXVI.

Fig. 1. *Bunodaster ritteri* Verrill. Type. A group of dorsal parapaxillæ from the base of a ray; × 10.

Fig. 1*a*. The same specimen. A group of dorsal plates from the base of a ray, with spines removed; × 10.

Fig. 2. *Dermasterias imbricata* (Grube). Young. One of the interactinal areas deprived of spines; *ad*, adambulacral plates, *o*, jaw plates; *im*, inferomarginals; *p*, *p*, first rows; *P'*, *P'*, second rows of interactinal plates; 1, 1 and 2, 2 and 3, 3, first three pairs of interactinal plates; *u*, *u*, odd or unpaired plates; × 5.

Fig. 2*a*. The same specimen; *ad*, adambulacral plates from near base of ray; *p*, two rows of interactinal plates; *m*, inferomarginals; × 5.

Fig. 2*b*. The same specimen; *o*, *o*, jaw-plates; *ad*, adoral adambulacrals; *f*, rudimentary plates, perhaps superambulacral; *ib*, interbrachial septum; × 5.

Fig. 2*c*. The same specimen. Supramarginal plates, from inner side; 1, 1 and 2, 2, first and second interradial pairs; × 5.

Fig. 3. *Solaster stimpsoni* Verrill. Type. One of the adambulacral combs of spines.

Fig. 4. *Pteraster tesselatus* Ives. A jaw and adoral parts; *o*, *o*, apical oral spines; *o'*, *o'*, lateral oral spines; *e*, *e*, hyaline epioral spines; 1, 2, 3, first three pairs of adambulacral combs; × 5.

Fig. 4*a*. The same specimen. Portion from near middle of radial area; *am*, ambulacral groove; *a-d*, four combs of adambulacral spines; *m*, *m*, actinomarginal spines; *l*, latero-ventral surface; × 5.

Fig 4*b*. The same specimen. Part of an interbrachial area, rendered translucent by varnish; *a*, *a*, *a*, spinules of parapaxillæ as seen through the translucent skin; *m*, actinomarginal spines; *ad*, adambulacrals; × 5.

Fig. 4*c*. The same. One of the hyaline epioral spines; × 10.

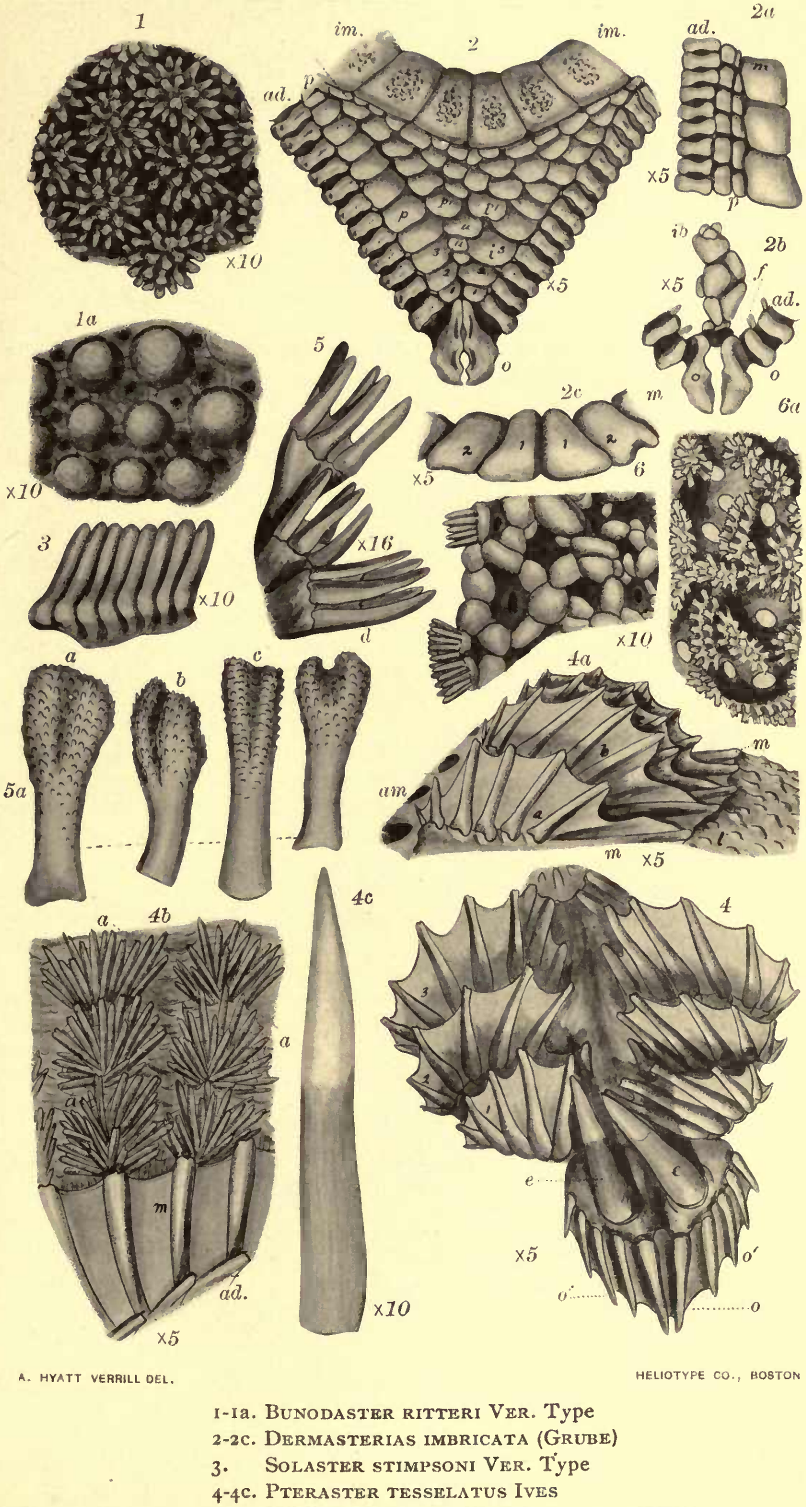
Fig. 5. *Henricia sanguinolenta* var. *rudis* Verrill. A group of dorsal pseudopaxillæ from the base of a ray; × 16. Point Franklin. No. 7623.

Fig. 5*a*. The same specimen. *a-d*, adambulacral spines; × 16.

Fig. 6. *Henricia tumida borealis* Verrill. Type. A group of dorsal ossicles, mostly with spinules removed from the base of a ray; × 10.

Fig. 6*a*. The same specimen. Group of dorsal pseudopaxillæ, with spinules and papular pores; × 10. Alaska, Harriman Expedition.

86



A. HYATT VERRILL DEL.

HELIOTYPE CO., BOSTON

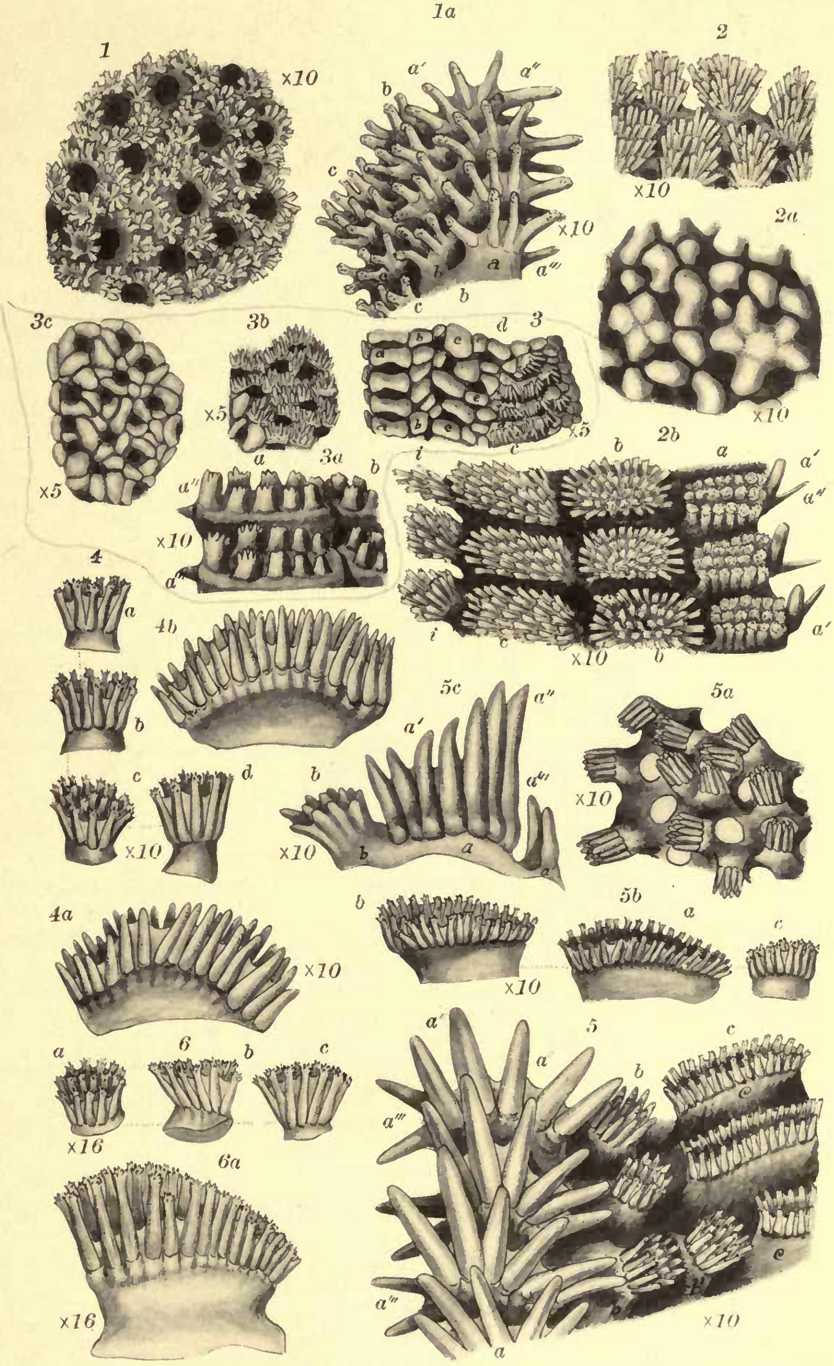
1-1a. Bunodaster ritteri Ver. Type
2-2c. Dermasterias imbricata (Grube)
3. Solaster stimpsoni Ver. Type
4-4c. Pteraster tesselatus Ives
5-5a. Henricia sanguinolenta, var rudis Ver.
6-6a. H. tumida borealis Ver. Type

87

87

PLATE LXXXVII.

Fig. 1.	*Henricia tumida* Verrill. Type. Portion of dorsal surface; × 10.
Fig. 1*a*.	The same specimen. Group of spines of actinal side; *a′*, *a′*, adambulacrals; *b*, *b′*, peractinals; *c*, *c′*, inferomarginals; × 10.
Fig. 2.	*Henricia leviuscula spiculifera* (Clark). Group of pseudopaxillæ from the side of the base of a ray; × 10. Bering Sea.
Fig. 2*a*.	The same specimen. Group of dorsal ossicles with spines removed; × 10.
Fig. 2*b*.	The same specimen. Portion of actinal side; *a*, *a′*, adambulacral plates and spines; *a″*, furrow-spine; *b*, *b*, peractinal pseudopaxillæ; *c*, *c*, inferomarginals; *d*, *d*, superomarginals; × 10.
Fig. 3.	*Henricia arctica* Verrill. Type. Cape Lisburne. Portion of actinal side with spines partly removed; *a*, *a*, adambulacral plates; *b*, *b*, peractinals; *c*, *c*, inferomarginals; *d*, *d*, superomarginals; *e*, *e*, intermarginals; × 5.
Fig. 3*a*.	The same specimen. *a*, *a*, two adambulacral plates and spines; *a′*, furrow-spine; *b*, peractinal.
Fig. 3*b*.	The same specimen. Group of dorsal pseudopaxillæ; × 5.
Fig. 3*c*.	The same specimen. Group of ossicles from base of ray; × 5.
Fig. 4	*Solaster endeca* (Linn.) Forbes. Typical from Atlantic; *a*, *b*, *c*, dorsal pseudopaxillæ from base of ray; *d*, superomarginal; × 10.
Figs 4*a*, 4*b*.	The same specimen. Inferomarginal plates; 4*a*, adoral side; 4*b*, aboral side; × 10.
Fig. 5.	*Solaster galaxides* Verrill. Type. Portion of actinal side; *a*, *a*, adambulacral spines, actinal group; *a′*, furrow-spines; *b*, *b*, *b′*, peractinals; *c*, *c*, inferomarginals.
Fig. 5*a*.	The same specimen. Group of dorsal pseudopaxillæ and papular pores from the base of a ray; × 10.
Fig. 5*b*.	The same specimen; *a*, adoral, and *b*, aboral sides of inferomarginal plates; *c*, superomarginal plate; × 10.
Fig. 5*c*.	*Solaster galaxides* Verrill. Cotype. *a*, actinal group of adambulacral spines; *a′*, furrow-spines; *b*, peractinals. No. 1897, Mus. Comp. Zoöl.
Fig. 6.	*Solaster dawsoni* var. *arctica* Verrill. Type. Dorsal pseudopaxillæ, *a*, *b*, *c*, from base of ray; × 16.
Fig. 6*a*.	The same specimen; inferomarginal plate; × 16. From Point Franklin.



Spiculifera

A. HYATT VERRILL DEL. HELIOTYPE CO., BOSTON

1-1a. Henricia tumida Ver. Type
2-2b. H. leviuscula spiculifera (Clark)
3-3c. H. arctica Ver. Type
4-4b. Solaster endeca (L.)
5-5c. S. galaxides Ver. Type
6-6a. S. dawsoni arcticus Ver. Type

88

88

PLATE LXXXVIII.

FIG. 1. *Henricia leviuscula* var. *inequalis* Verrill. Type. Portion of the actinal side of a ray; *a, a,* enlarged adambulacral spines; *a', a',* longer adambulacral spines on inner angle of plate; *b,* interactinals; *c,* second row of interactinal pseudopaxillæ; *d,* inferomarginal plates and spines; × 10. No. 5183, Yale Mus.

FIG. 1*a*. The same specimen. Group of dorsal pseudopaxillæ and papulæ from base of a ray; × 10.

FIG. 2. *Henricia leviuscula* var. *lunula* Verrill. Type. Group of dorsal ossicles from the base of a ray, cleaned; × 5. British Columbia. Yale Mus.

FIG. 2*a*. The same specimen. Plates of the actinal side of the middle of a ray, cleaned; *a, a,* adambulacrals; *b, b,* peractinals; *c, c,* inferomarginals; *d, d,* superomarginals; *e, e,* latero-dorsals; *f,* two adambulacral spines; × 5.

FIG. 2*c*. The same specimen. Plates of actinal side, more enlarged (× 10). Lettering as in fig. 2*a*.

FGI. 2*c*. The same specimen; *a,* adambulacral spines; *a',* enlarged inner spine; *a'',* furrow-spine; *b,* peractinal spines; × 10.

FIG. 3. *Henricia sanguinolenta* (Müller). Typical form from New England. A jaw and adjacent parts; *o, o, o',* apical or peroral spines; *o'', o'',* lateral adoral spines; *a', a'',* adambulacral spines of first and second free plates; *d, d,* exsert papulæ; × 5. Eastport, Me. (coll., A. E. Verrill). Yale Mus., No. 5099.

FIG. 3*a*. The same specimen. Spines from the actinal side near the base of a ray; *a, a,* adambulacral plates; *a', a'',* adambulacral spines; *a''',* furrow spine; *b, b',* interactinal spines; *d, d,* papulæ; × 5.

FIG. 4. *Henricia sanguinolenta miliaris* Verrill. Type. From a New England specimen. A portion of the actinal surface of the middle of a ray; × 10. Lettering as in fig. 3*a*, with addition of *c, c,* the inferomarginal plates.

FIG. 4*a*. The same specimen. Group of dorsal pseudopaxillæ from near base of a ray; × 10. Eastport, Me. (coll., A. E. Verrill). Yale Mus.

FIG. 5. *Henricia tumida borealis* Verrill. Type. Portion of plates and spines from the actinal side near the base of a ray; × 10. Lettering as in figs. 3*a* and 4. Dutch Harbor, Alaska, Harriman Expedition. Yale Mus.

FIG. 5*a*. The same specimen. *a, a,* ambulacral spines; *a', a',* larger spines on edge of groove; *b, b,* peractinal spines; × 10.

FIG. 5*b*. The same specimen. Adoral adambulacral plates and spines; × 10. Lettering as in fig. 5*a*.

error ?

FIG. 6. *Orthasterias forreri forcipulata* Verrill. Type. Larger dorsal, dermal, major pedicellariæ of three sorts; *a, b,* stout, erect denticulate form; *c,* spatulate or plataleiform sort; *d,* lanceolate form; × 43.

FIG. 6*a*. The same specimen. Minor pedicellariæ of different sizes, *a-f;* × 43.

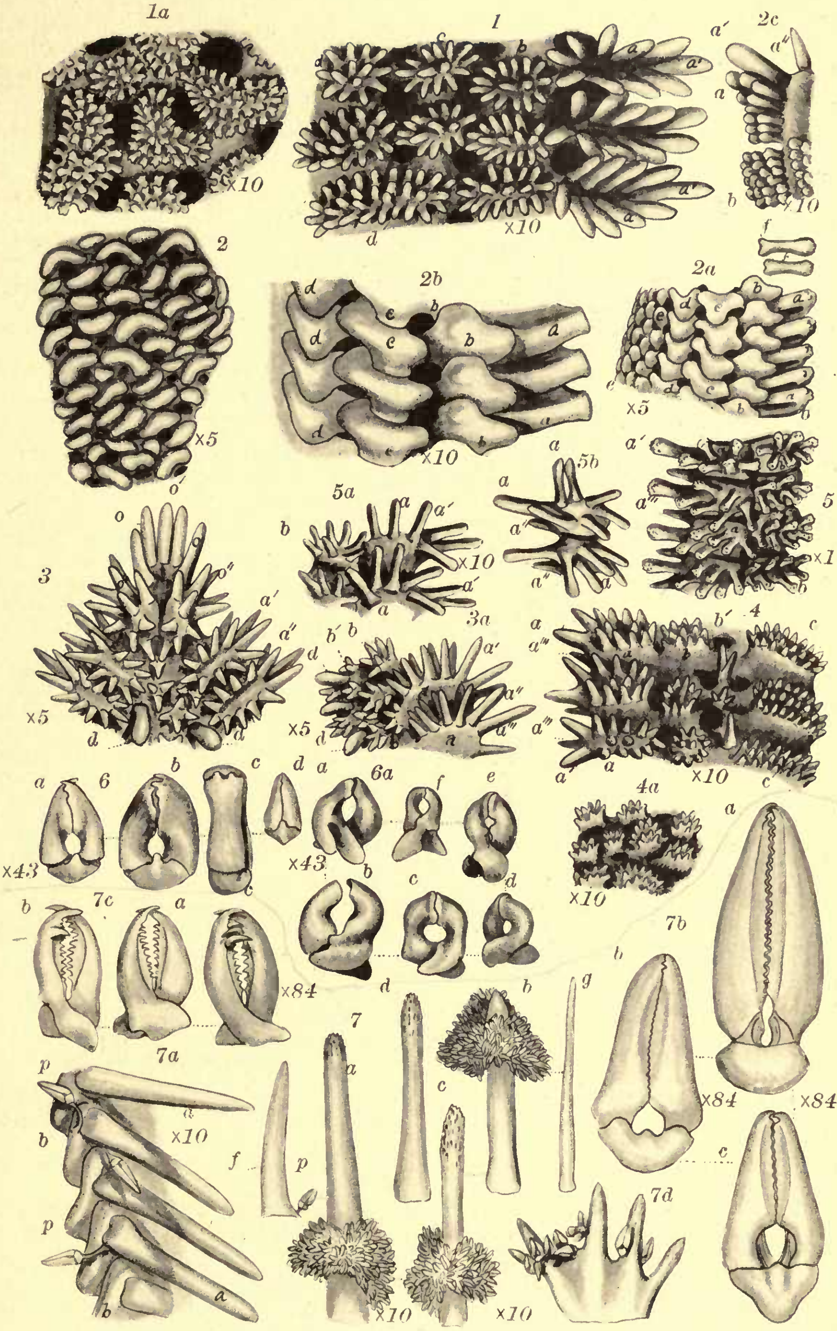
FIG. 7. *Pycnopodia helianthoides* (Brandt). Spines; *a, b, c,* dorsals with wreaths of minor pedicellariæ; *d,* the same, cleaned of the pedicellariæ; *f,* an adambulacral spine with a pedicellaria (*P*) attached to its base by a pedicel on the edge of the furrow; *g,* an adoral spine, cleaned; × 10.

FIG. 7*a*. The same specimen. A group (*b, b*) of adambulacral overlapping plates; *a, a,* adambulacral spines; *p, p,* major pedicellariæ on slender pedicels; × 10.

FIG. 7*b*. The same specimen. *a, b, c,* three forms of small lanceolate major pedicellariæ; × 84.

FIG. 7*c*. The same specimen. *a, b, c,* three of the minor pedicellariæ; × 84.

FIG. 7*d*. The same specimen. One of the jaws with apical or peroral spines and pedicellariæ; × 10.



A. HYATT VERRILL DEL.

HELIOTYPE CO., BOSTON

1-1a. Henricia leviuscula, var.
2-2c. H. leviuscula, var. lunula Ver. Type
3-3a. H. sanguinolenta (Mull.) Typical
4-4a. H. sanguinolenta miliaris Ver. Type
5-5b. H. tumida borealis Ver. Type
6-6a. Orthasterias forreri forcipulata Ver. Type
7-7d. Pycnopodia helianthoides (Br.)

89

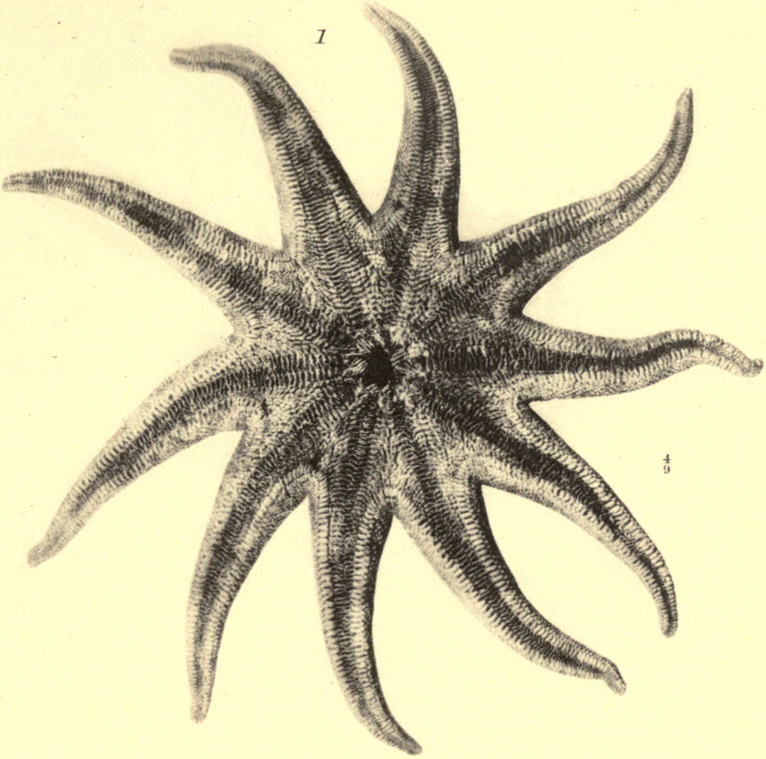
89

PLATE LXXXIX.

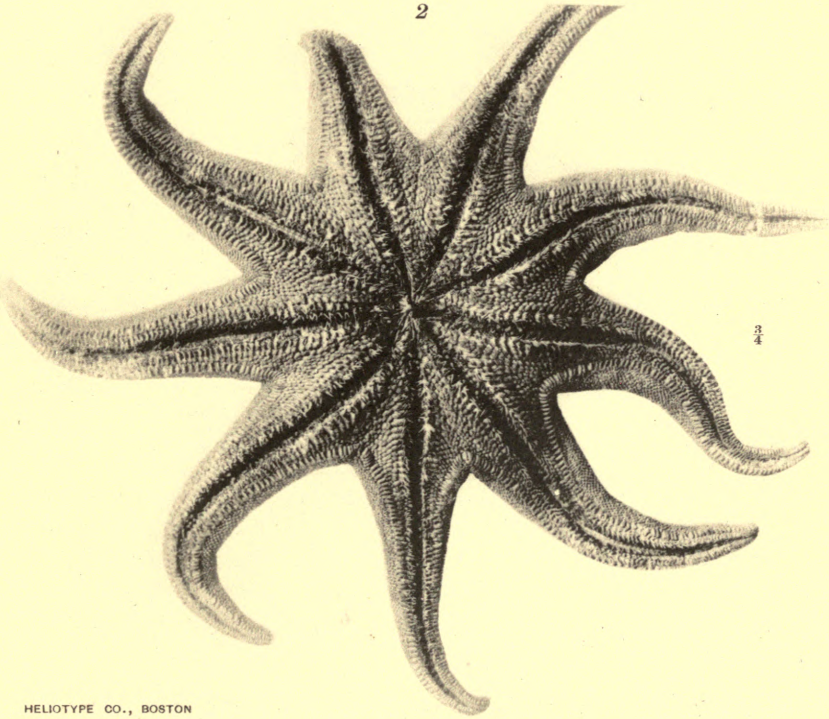
Fig. 1. *Solaster endeca* (Linn.) Forbes. Typical. Actinal side of a large New England specimen; 4/9 natural size. Eastport, Me. Yale Mus.

Fig. 2. *Solaster galaxides* Verrill. Type. ¾ natural size. Vancouver Is.

1



2



HELIOTYPE CO., BOSTON

1. Solaster endeca (L.) Atlantic
2. S. galaxides Ver. Type

90

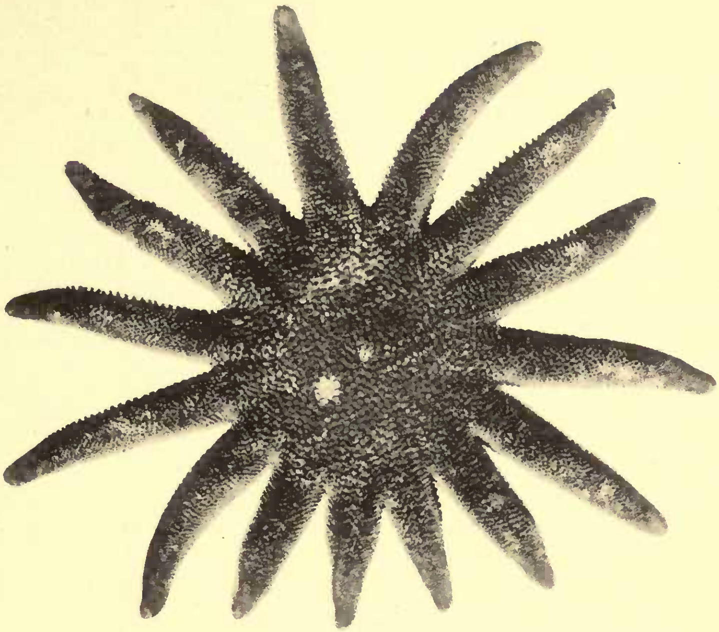
90

PLATE XC.

Fig. 1. *Solaster dawsoni* Verrill. Form with different rays; about natural size. Vancouver I., Surv. Canada.

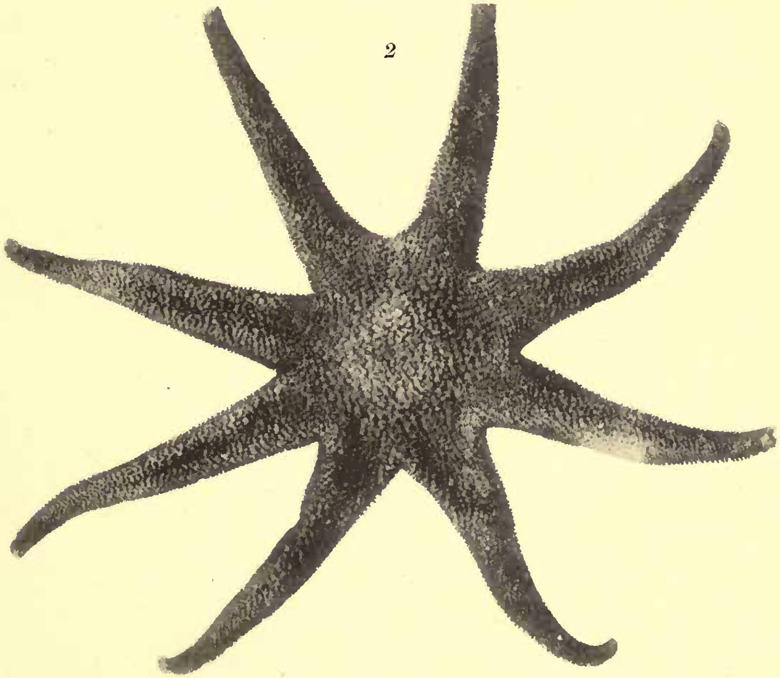
Fig. 2. *Solaster constellatus* Verrill. Type. About ¾ natural size.

1



1/1

2



3/4

HELIOTYPE CO., BOSTON

1. Solaster dawsoni Ver.

2. Solaster constellatus Ver. Type

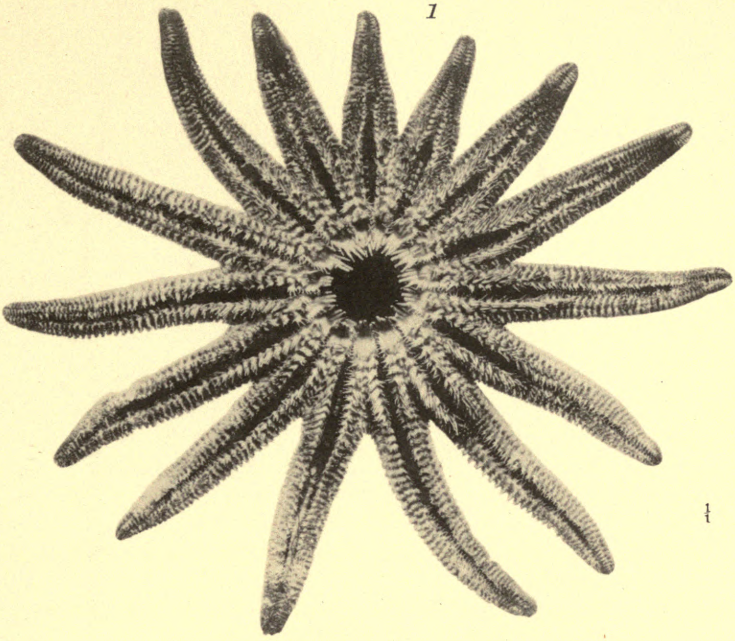
91

PLATE XCI.

FIG. 1. *Solaster dawsoni* Verrill. Form with fifteen rays. Actinal side; about natural size.

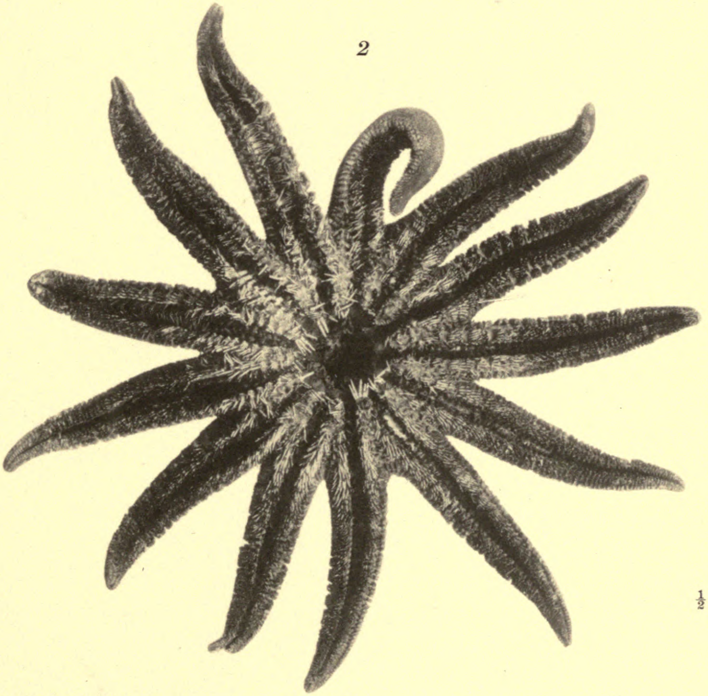
FIG. 2. *Solaster dawsoni* Verrill. Cotype. Actinal side; about ½ natural size. Powell Is. Geol. Surv. Canada.

1



1/1

2



1/2

HELIOTYPE CO., BOSTON

1.2. Solaster dawsoni Ver.

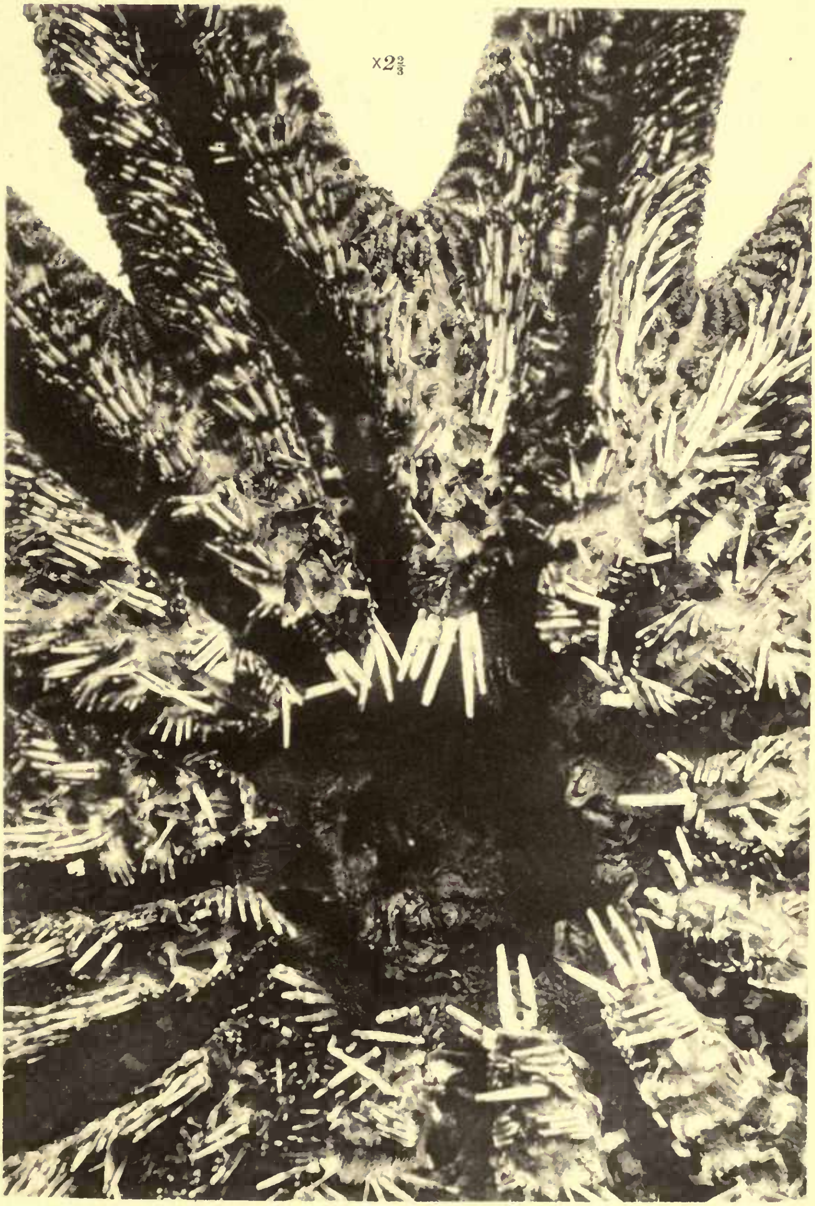
92

92

PLATE XCII.

FIG. 1. *Solaster dawsoni* Verrill. Cotype. Same specimen as pl. XC, fig. 2. Actinal side; × 2⅔. Powell Is.

92



HELIOTYPE CO., BOSTON

SOLASTER DAWSONI VER. Cotype

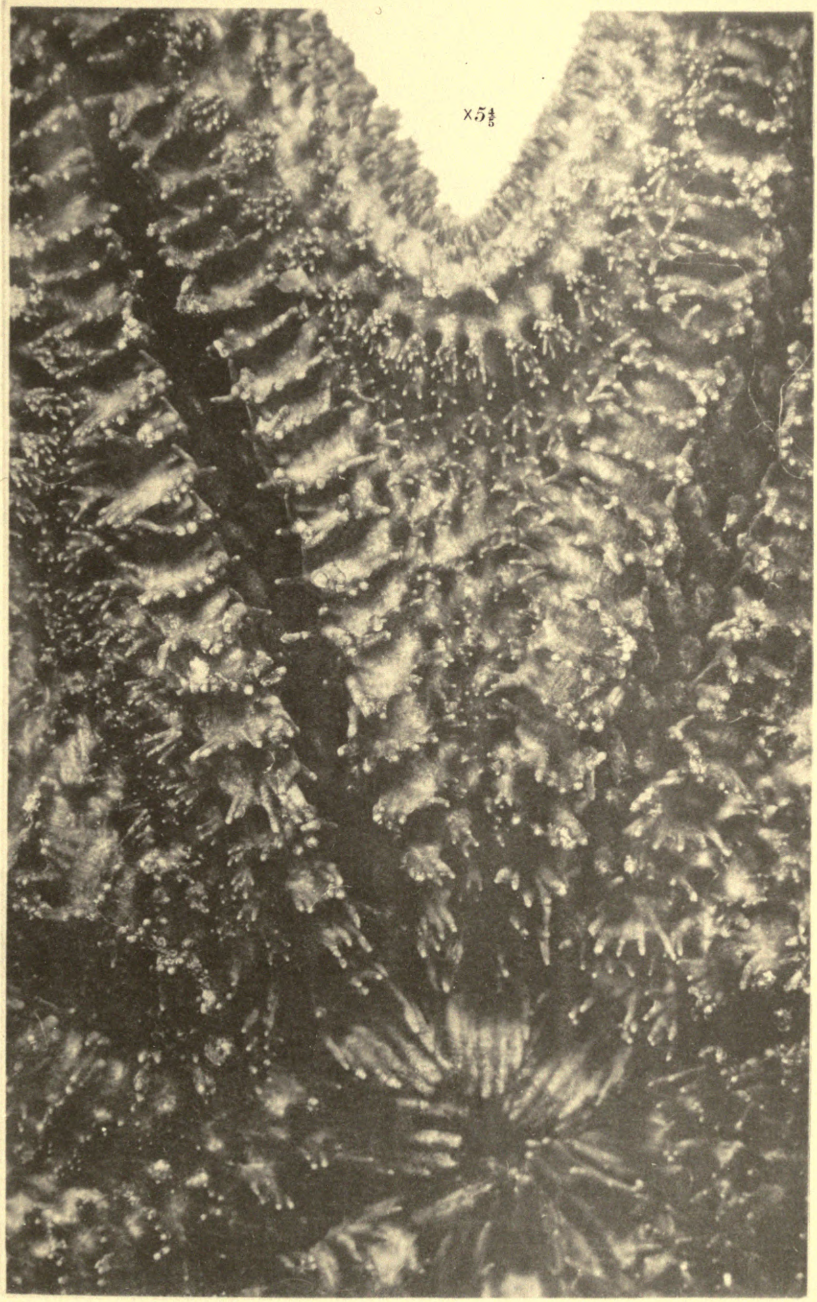
93

93

PLATE XCIII.

FIG. 1. *Solaster constellatus* Verrill. Type. Actinal side; × 5⅘. Puget Sound. Mus. Univ. of Wash.

93



HELIOTYPE CO., BOSTON

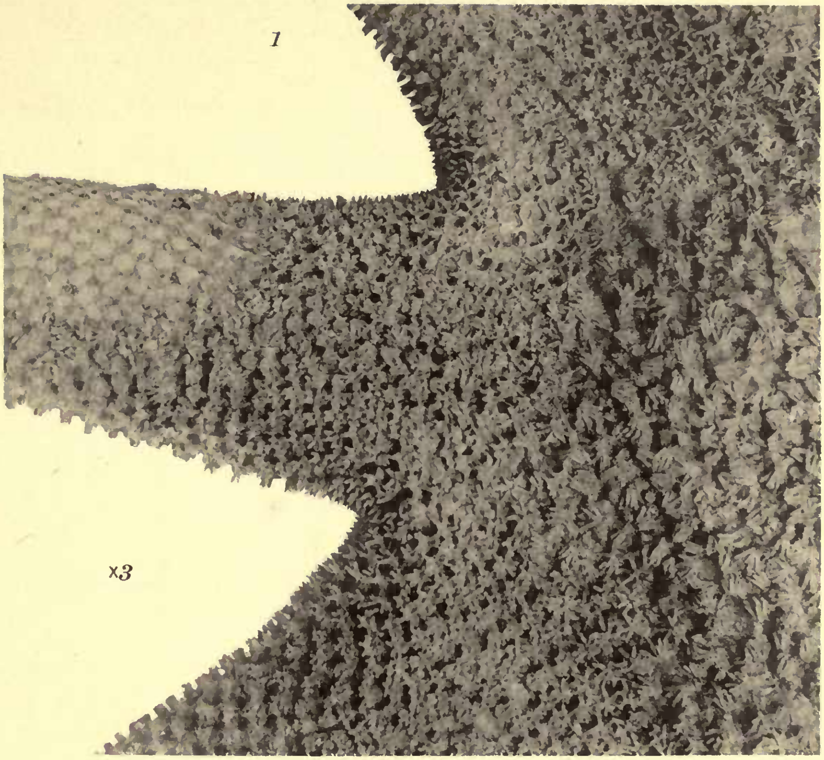
Solaster constellatus Ver. Type

94

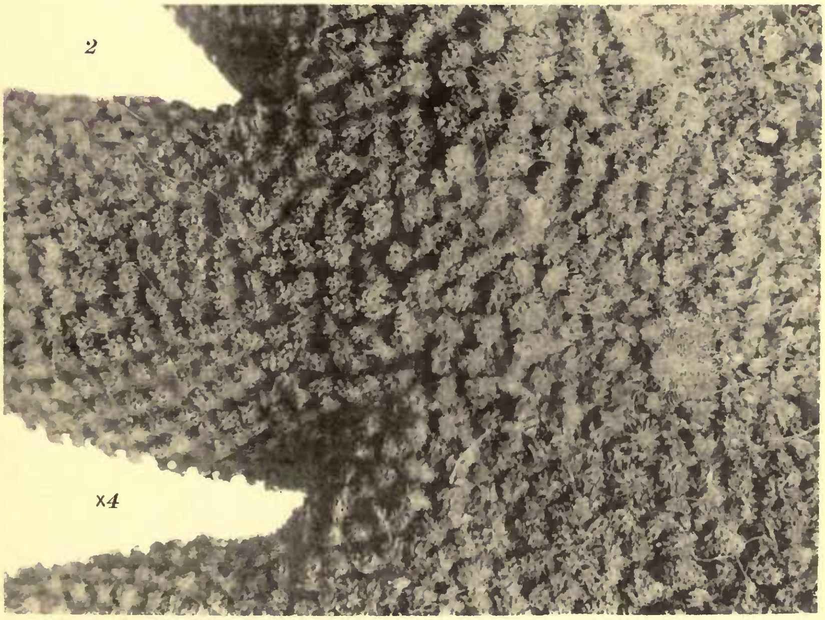
94

PLATE XCIV.

FIG. 1. *Solaster constellatus* Verrill. Type. Dorsal side; × 3.
FIG. 2. *Solaster stimpsoni* Verrill. Type. Dorsal side; × 4.


1

x3


2

x4

HELIOTYPE CO., BOSTON

1. Solaster constellatus Ver. Type
2. Solaster stimpsoni Ver. Type

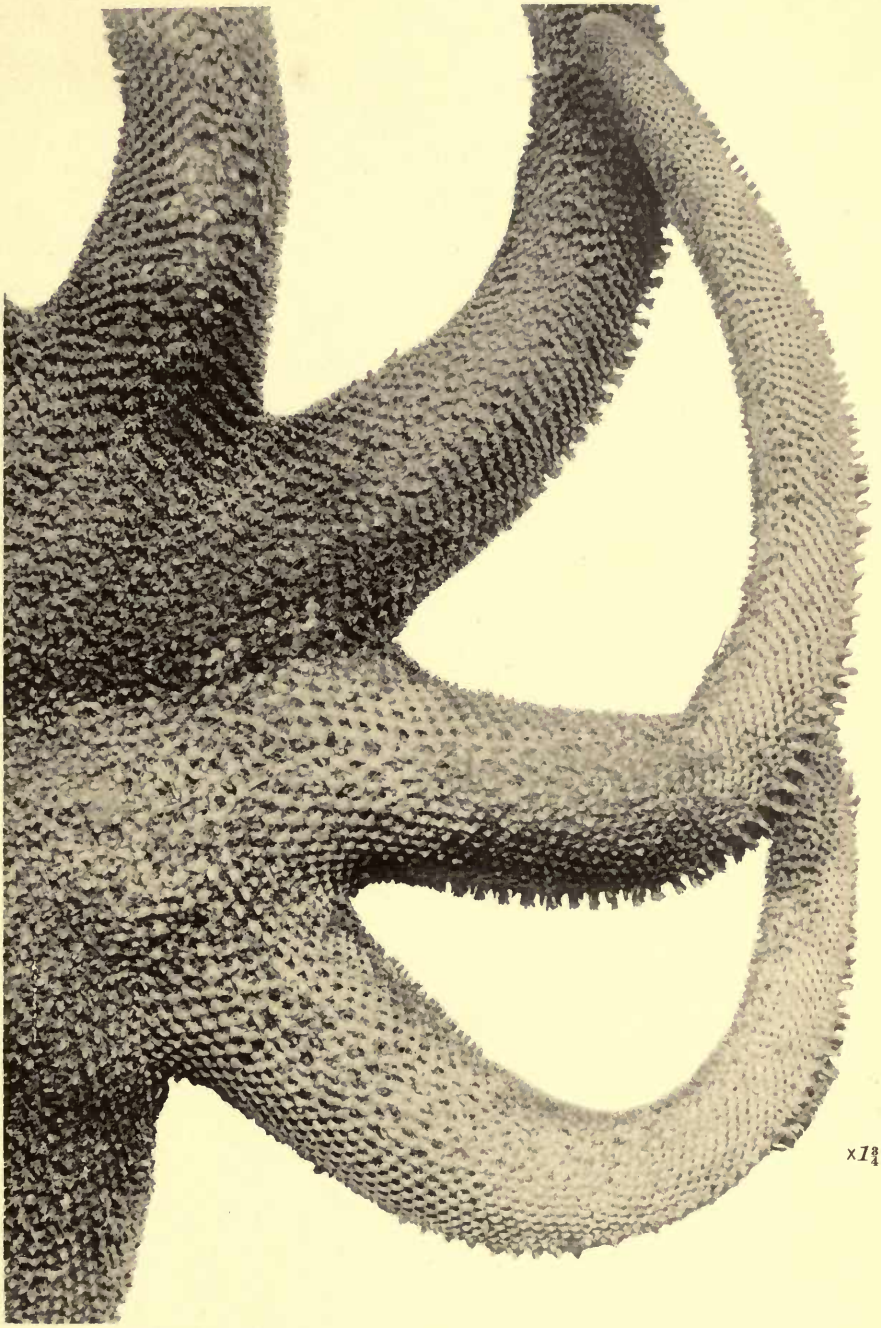
95

95

PLATE XCV.

Fig. 1. *Solaster stimpsoni* Verrill. Type. Dorsal side; × 1¾. No. 5407, Yale Mus.

95



HELIOTYPE CO., BOSTON

Solaster stimpsoni Ver. Type

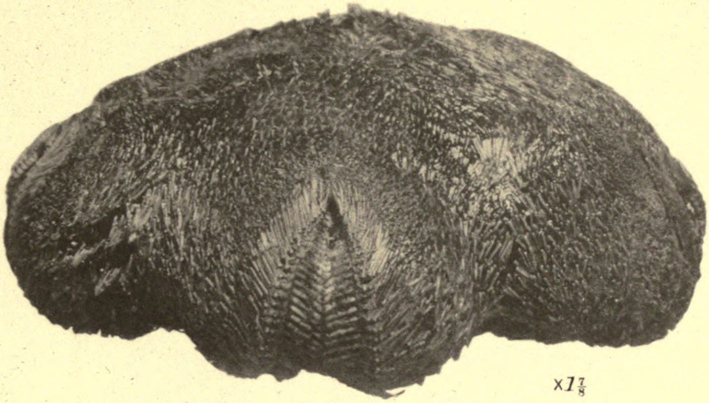
96

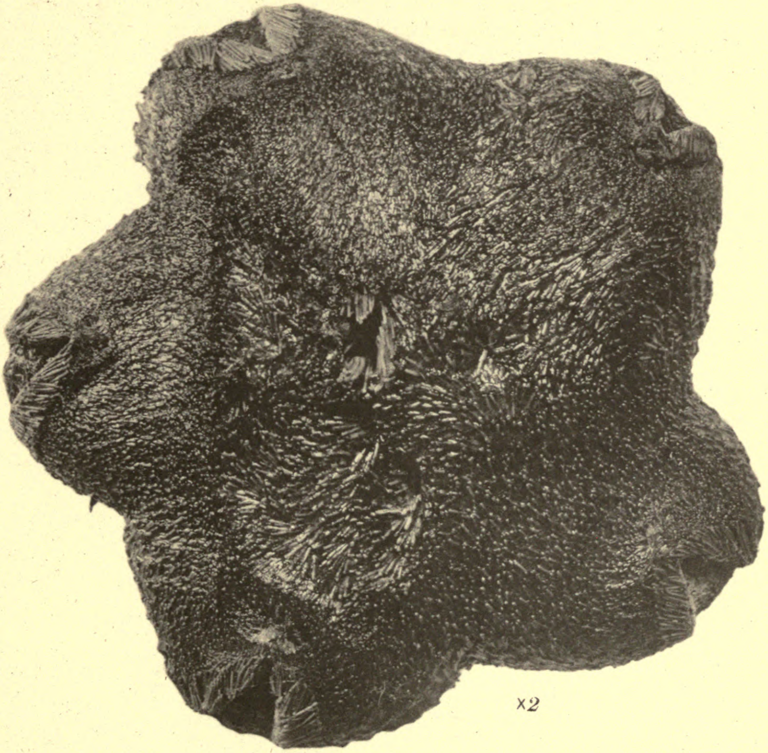
96

PLATE XCVI.

FIGS. 1, 2. *Pteraster hebes* Verrill. Type. Profile and dorsal views; 1, × about 1⅞; 2, × 2. Departure Bay. Geol. Surv. Canada.

96





HELIOTYPE CO., BOSTON

1.2. Pteraster hebes Ver. Type

97

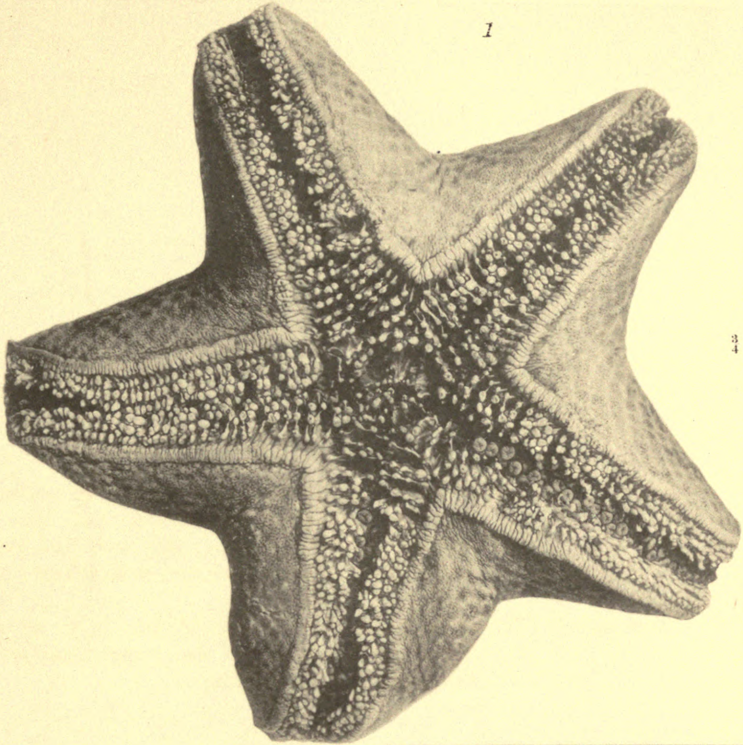
PLATE XCVII.

FIG. 1. *Pteraster tesselatus* Ives. Actinal side of an alcoholic specimen from Alaska; about ¾ natural size. Yale Mus.

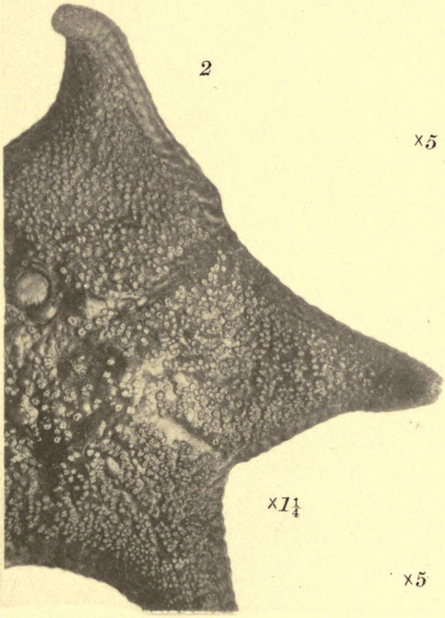
FIG. 2. *Dermasterias imbricata* (Grube), var. *valvifera* Verrill. Type. Dorsal side, showing abundant pedicellariæ; × 1¼. Yale Mus.

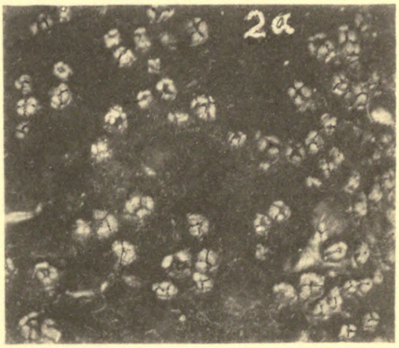
FIGS. *2a, 2b.* The same specimen. Portions of disk; × 5. *2a,* shows many three-valved pedicellariæ and some four-valved; fig. *2b,* shows also the madreporite.

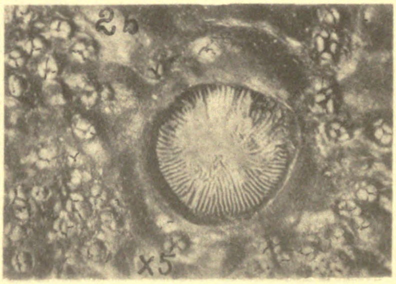
1



2







HELIOTYPE CO., BOSTON

1. Pteraster tesselatus Ives

2-2b. Dermasterias imbricata valvulifera Ver. Type

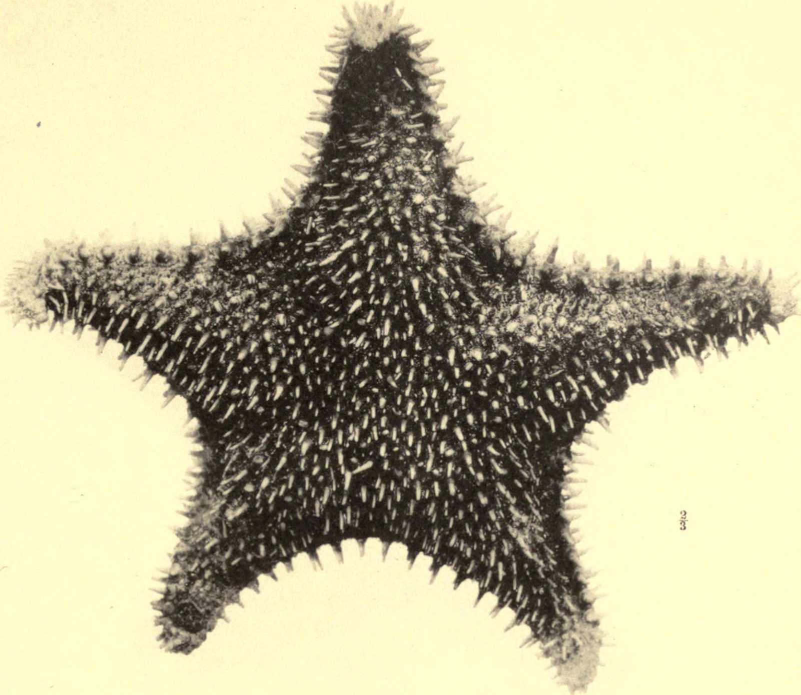
98

PLATE XCVIII.

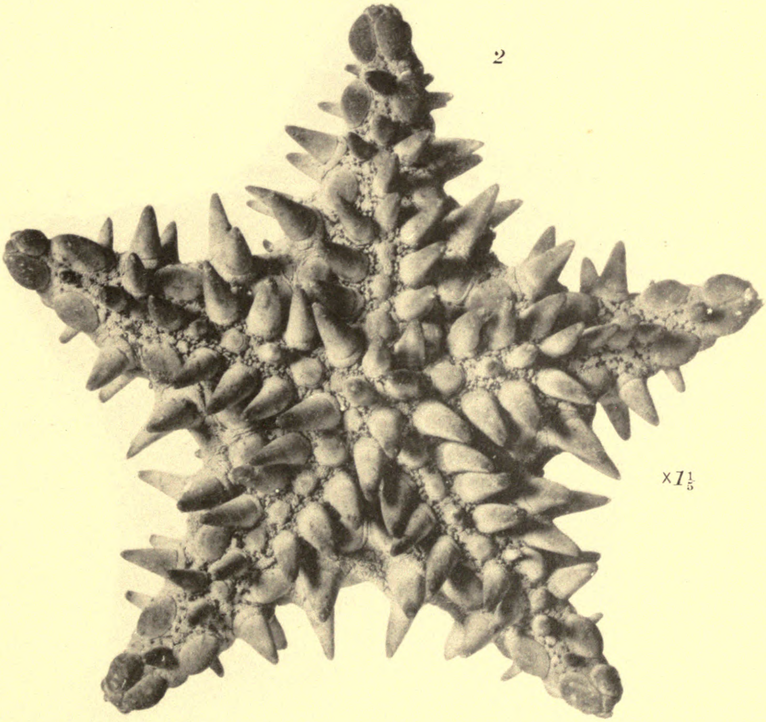
FIG. 1. *Hippasteria spinosa* Verrill. Type. Dorsal side; ⅔ natural size. Puget Sound. Univ. of Wash.

FIG. 2. *Amphiaster insignis* Verrill. Type. Dorsal side; × 1⅙. La Paz, Lower Calif. Yale Mus.

1



2



HELIOTYPE CO., BOSTON

1. Hippasteria spinosa Ver. Type
2. Amphiaster insignis Ver. Type

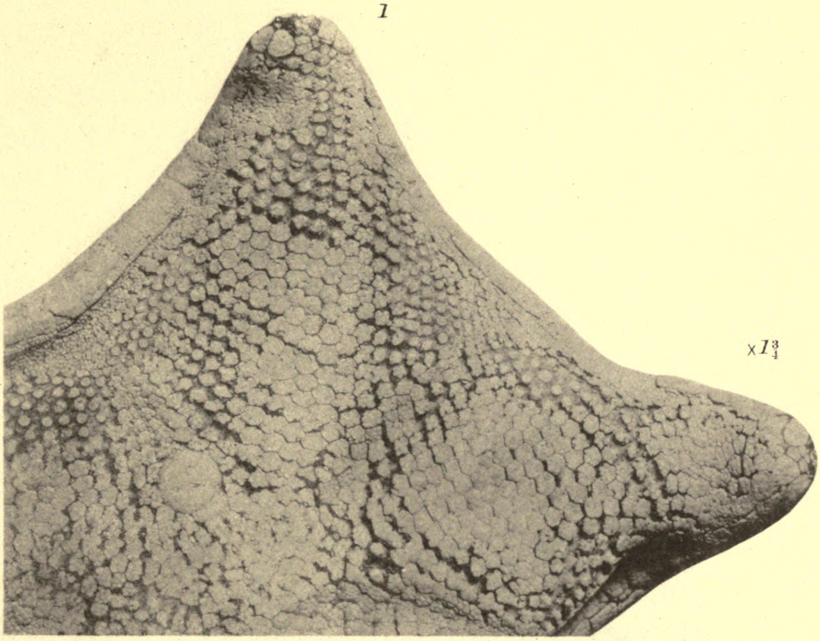
99

PLATE XCIX.

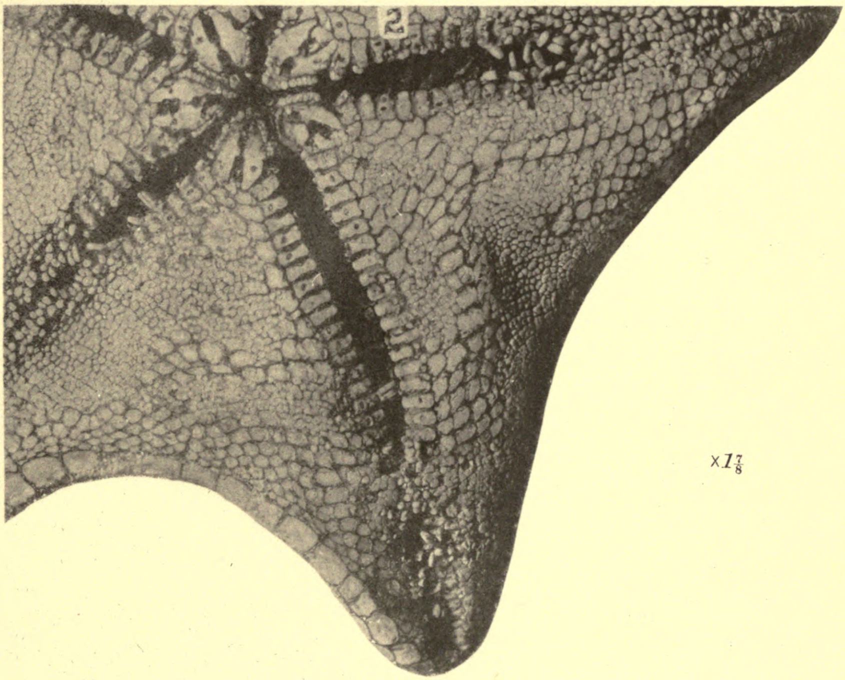
Fig. 1. *Tosiaster arcticus* Verrill. Dorsal side; × 1¾.

Fig. 2. The same specimen. Actinal side; × 1⅞. Bering Is. U. S. Nat. Mus.

1



2



HELIOTYPE CO., BOSTON

1.2. TOSIASTER ARCTICUS VER. Type

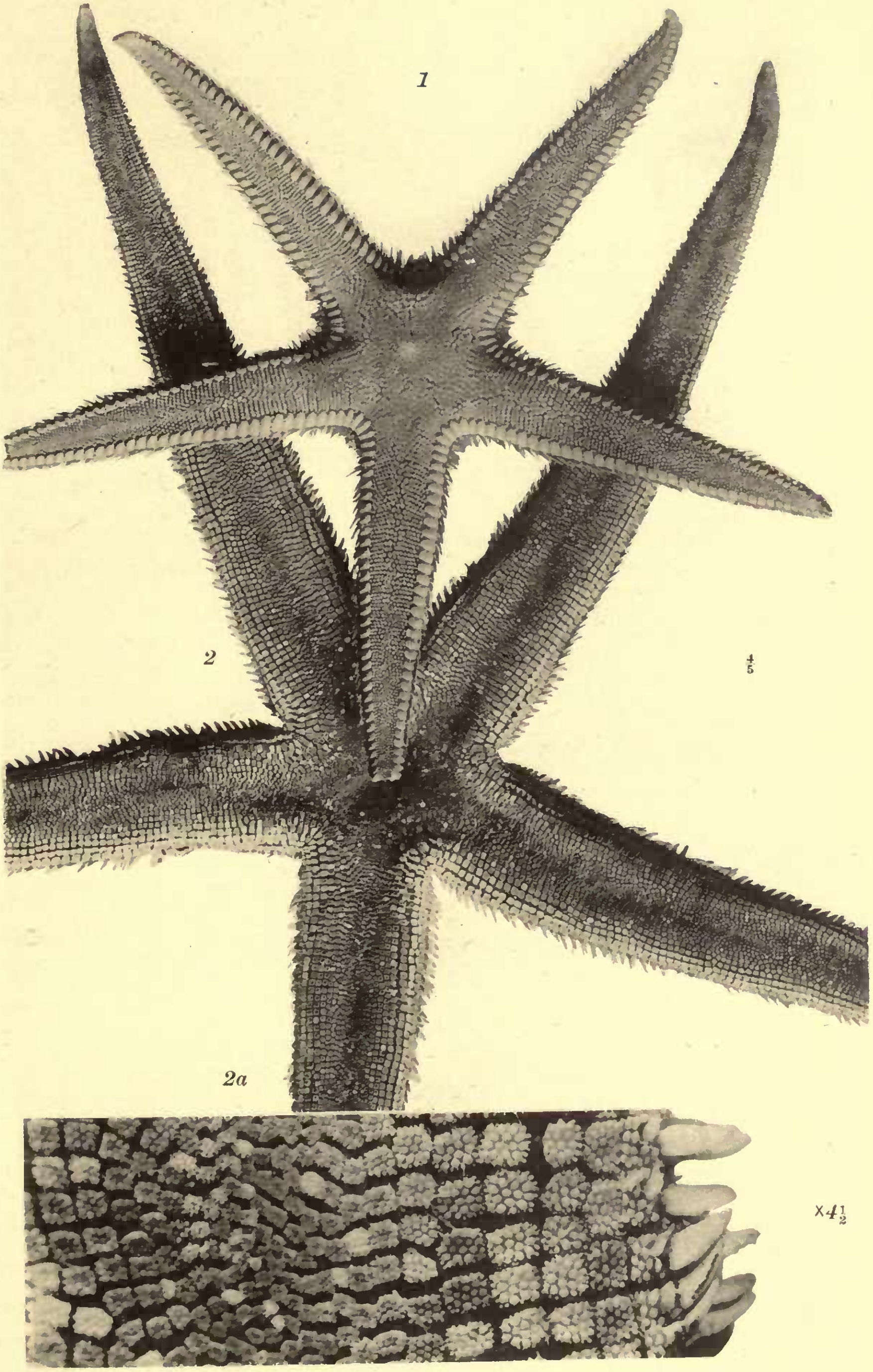
100

PLATE C.

FIG. 1. *Astropecten californicus* Fisher; ⅘ natural size. San Francisco.

FIG. 2. *Luidia foliolata* (Grube). Dorsal side; ⅘ natural size. San Francisco.

FIG. 2*a*. The same. Portion of a ray; × 4½.



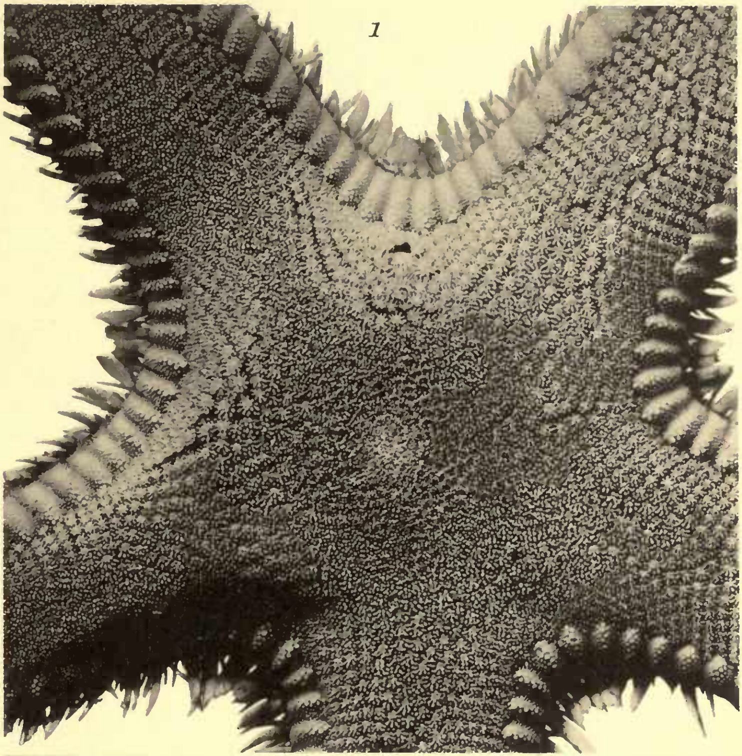
HELIOTYPE CO., BOSTON

1. ASTROPECTEN CALIFORNICUS FISHER
2.2a. LUIDIA FOLIOLATA GRUBE

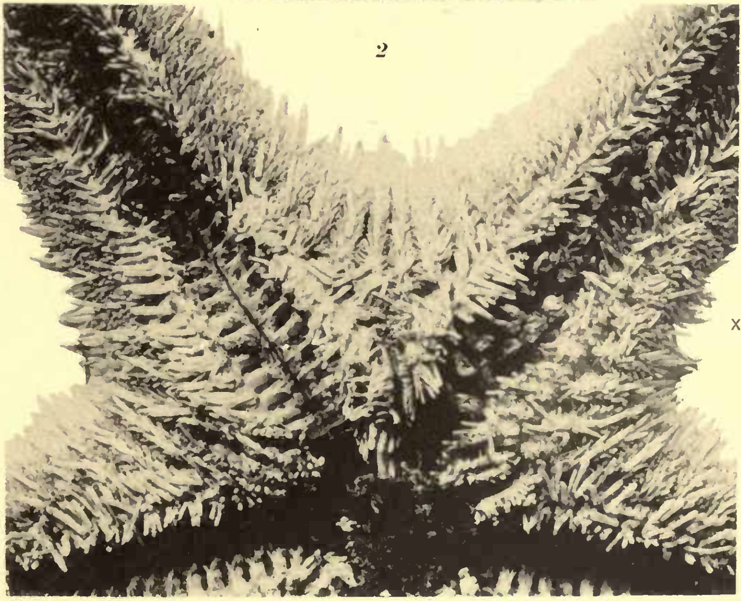
101

PLATE CI.

FIG. 1. *Astropecten californicus* Fisher. Dorsal side; × 3. San Francisco.
FIG. 2. The same specimen. Actinal side; × 2⅓.



×3



×2⅓

HELIOTYPE CO., BOSTON

Astropecten californicus Fisher

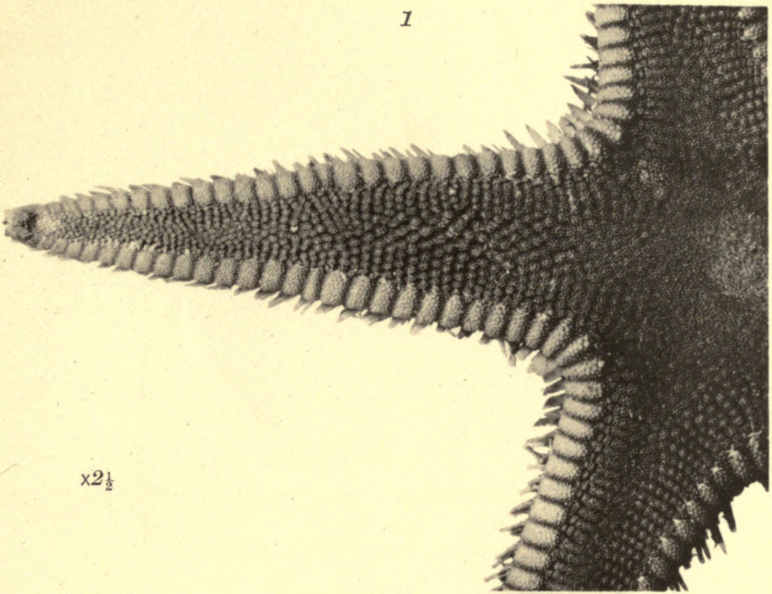
102

PLATE CII.

FIG. 1. *Astropecten californicus* Fisher. Young. Dorsal side; × 2½. Off San Francisco. Yale Mus.

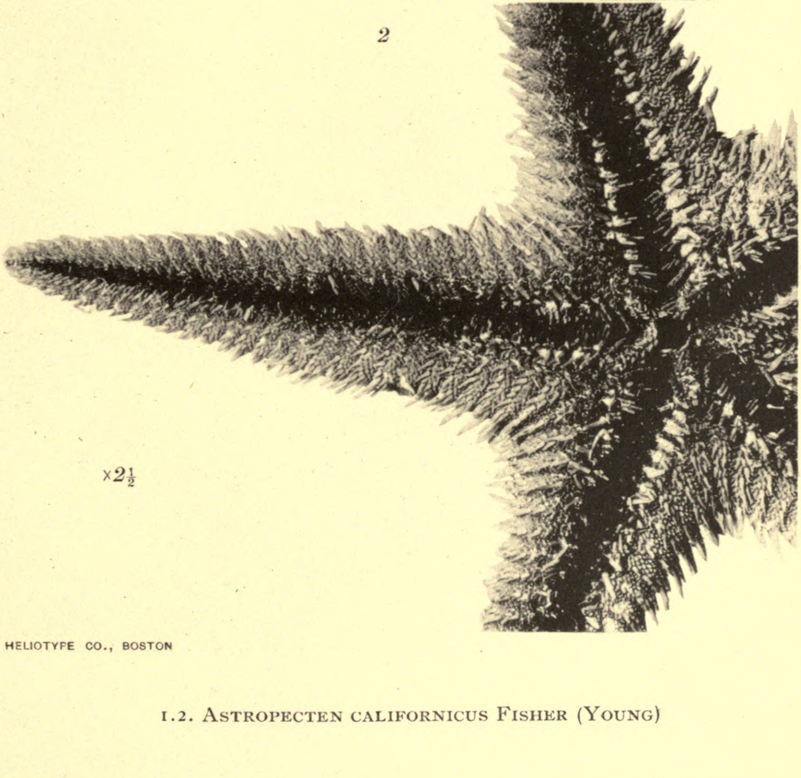
FIG. 2. The same specimen. Actinal side; × 2½.

1



x2½

2



x2½

HELIOTYPE CO., BOSTON

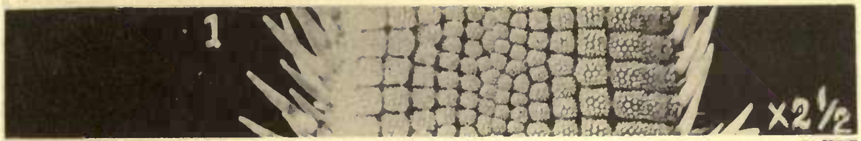
1.2. Astropecten californicus Fisher (Young)

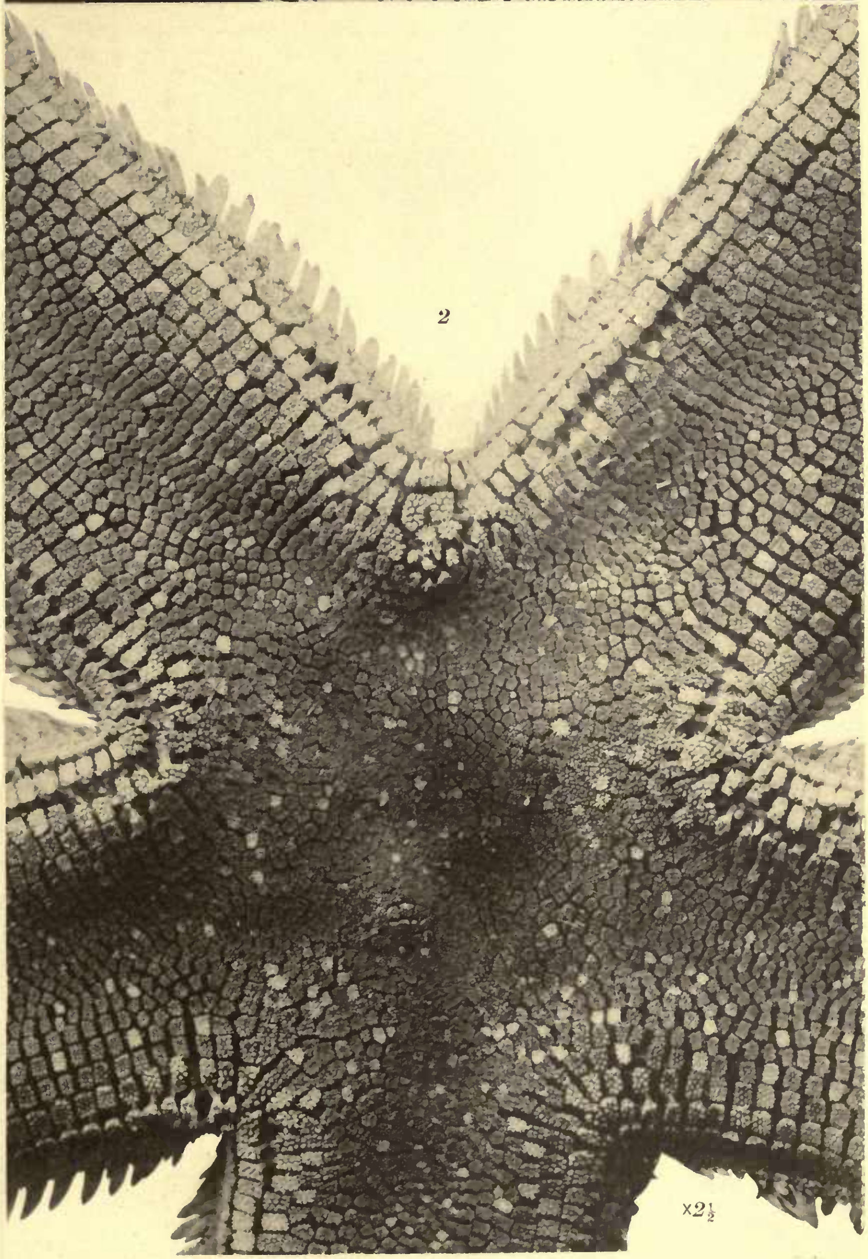
103

PLATE CIII.

Fig. 1. *Luidia clathrata* (Say). Dorsal side of ray; × 2½. Bermuda.

Fig. 2. *Luidia foliolata* (Grube). Dorsal side; × 2½. San Francisco. Yale Mus.





HELIOTYPE CO., BOSTON

1. Luidia clathrata Say.
2. Luidia foliolata Grube

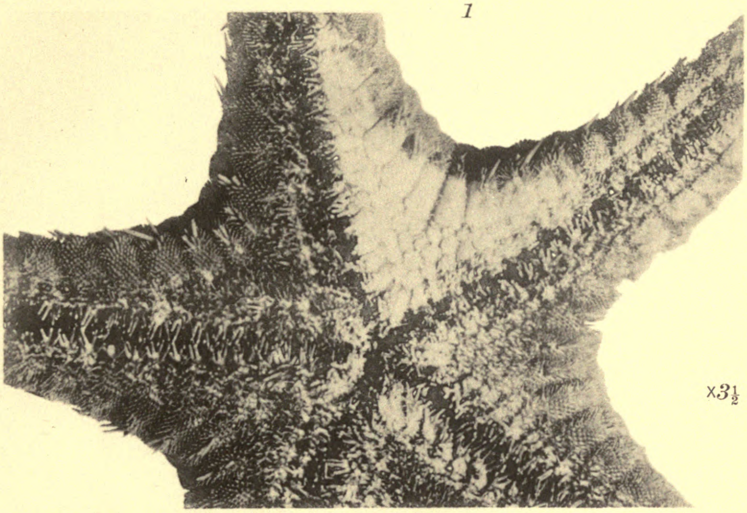
104

PLATE CIV.

FIG. 1. *Bunodaster ritteri* Verrill. Type. Actinal side; × 3⅓. Off San Francisco. Yale Mus.

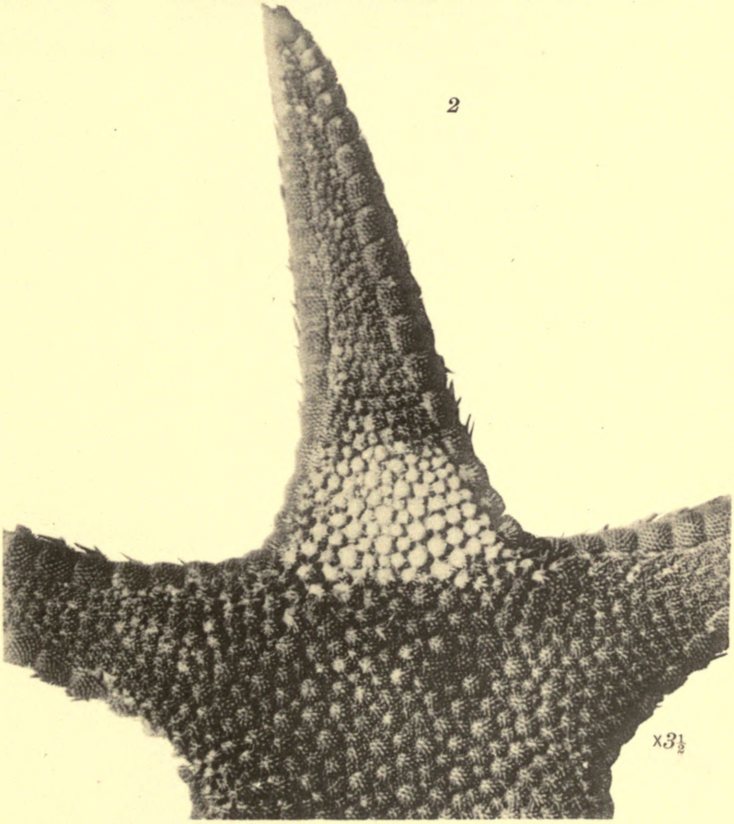
FIG. 2. The same specimen. Dorsal side with spines removed on base of one ray; × 3⅓.

1



x$3\frac{1}{2}$

2



x$3\frac{1}{2}$

HELIOTYPE CO., BOSTON

BUNODASTER RITTERI VER. Type

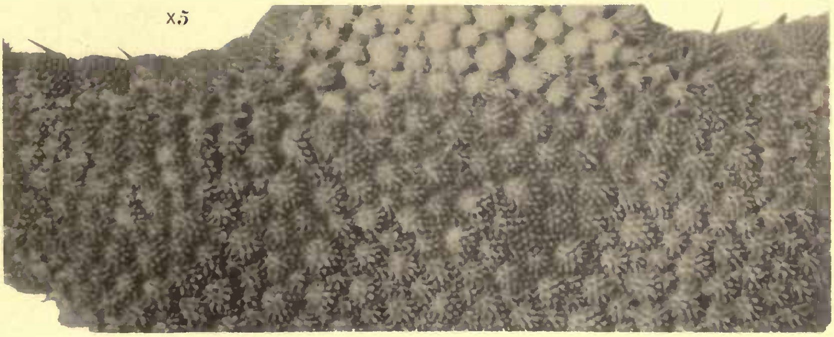
105—

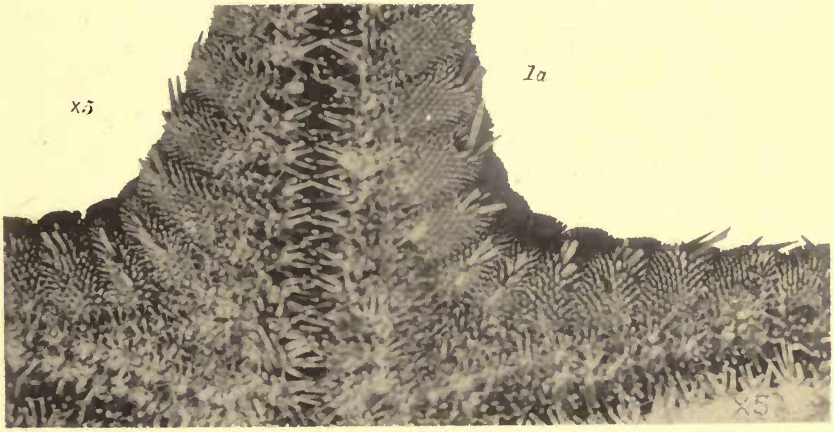
PLATE CV.

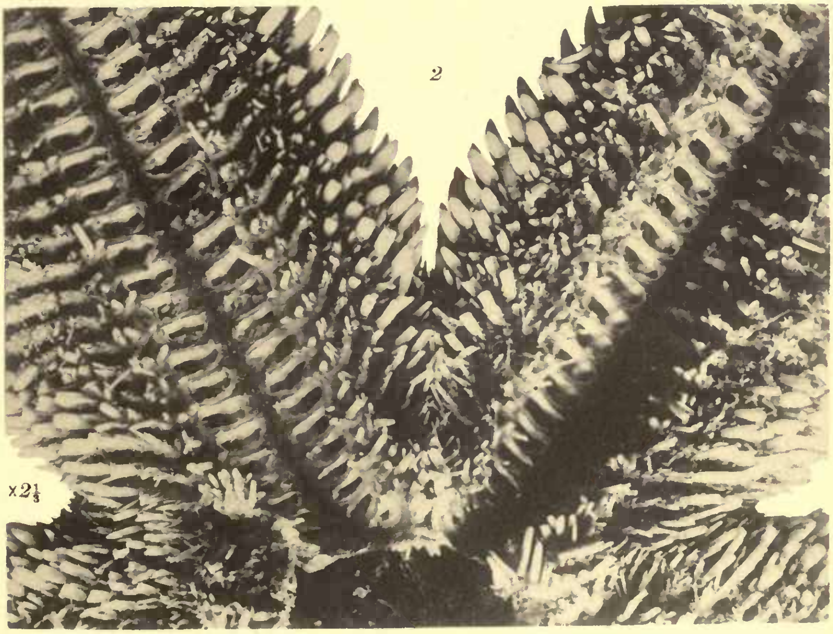
FIGS. 1, 1a. *Bunodaster ritteri* Verrill. Type. Portions of the dorsal and actinal surface; × 5. San Francisco.

FIG. 2. *Luidia foliolata* (Grube). Same specimen as pl. C, fig. 2. Actinal side; × 2. Off San Francisco.

1







HELIOTYPE CO., BOSTON

1.1a. BUNODASTER RITTERI VER.
2. LUIDIA FOLIOLATA GRUBE

106

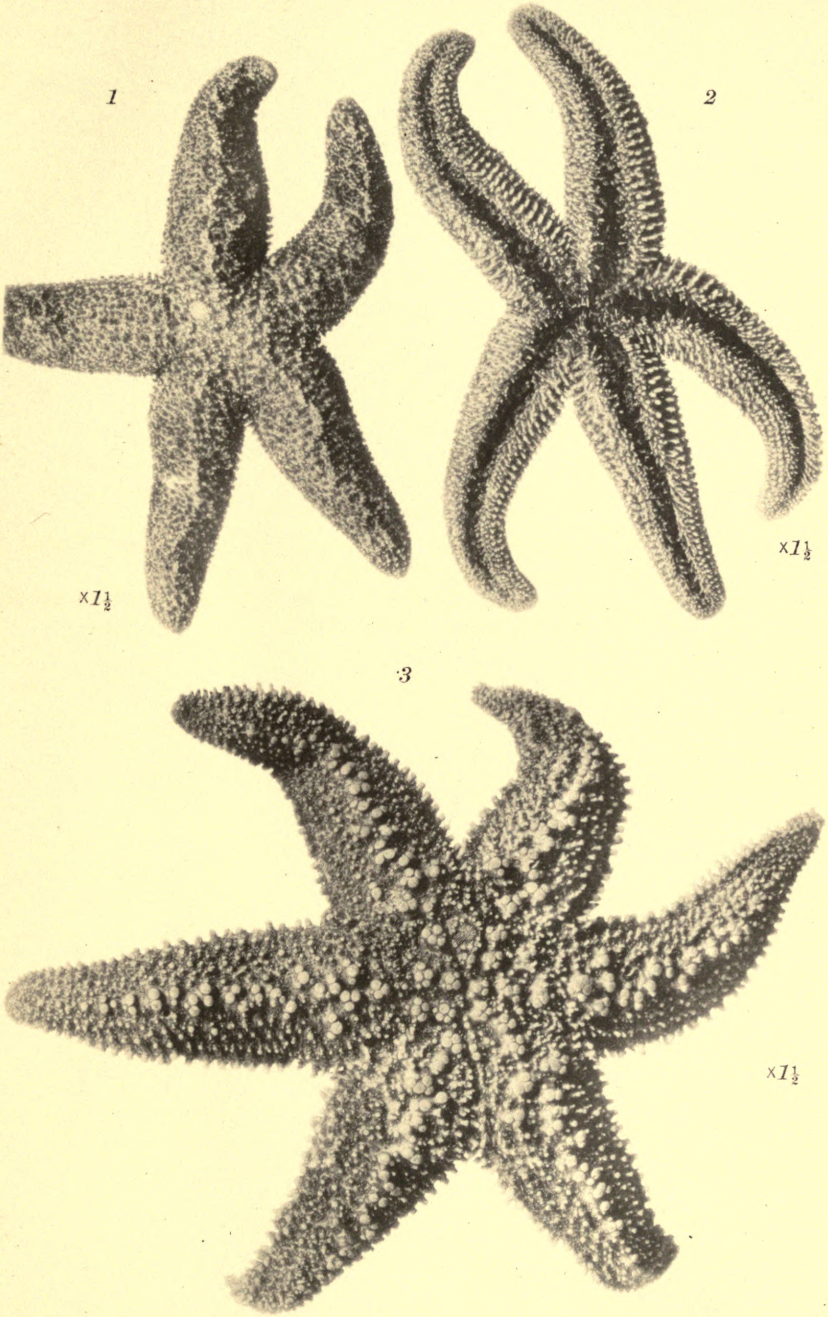
106

PLATE CVI. var parvispina

FIGS. 1, 2. *Evasterias troschelii* (Stimpson) Verrill. Young. Dorsal and actinal sides; × 1½. Sitka. Yale Mus.

FIG. 3. *Asterias acervata* Stimpson. A strongly acervate young specimen; × 1½. Nazan, Alaska (Dall). U. S. Nat. Mus.

L. dispar



HELIOTYPE CO., BOSTON

1, 2. Evasterias troschelii (St.) Young
3. Asterias acervata (St.) Young, Var.

107

107

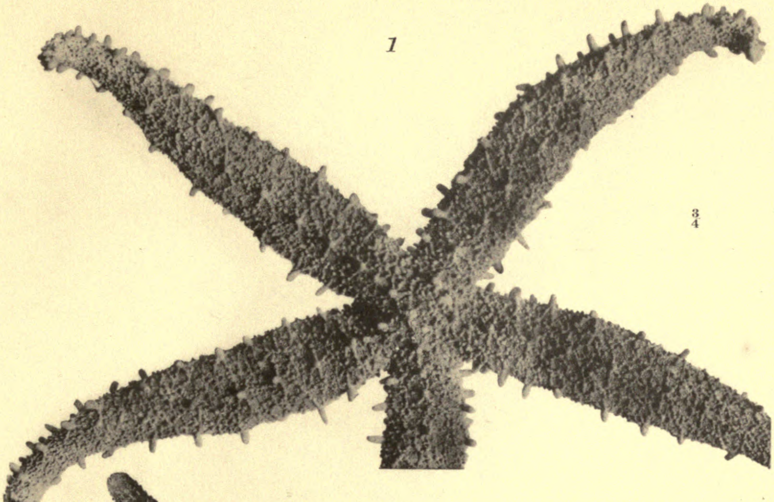
PLATE CVII.

FIG. 1. *Mithrodia bradleyi* Verrill. Type. Dorsal side; ¾ natural size. Yale Mus.

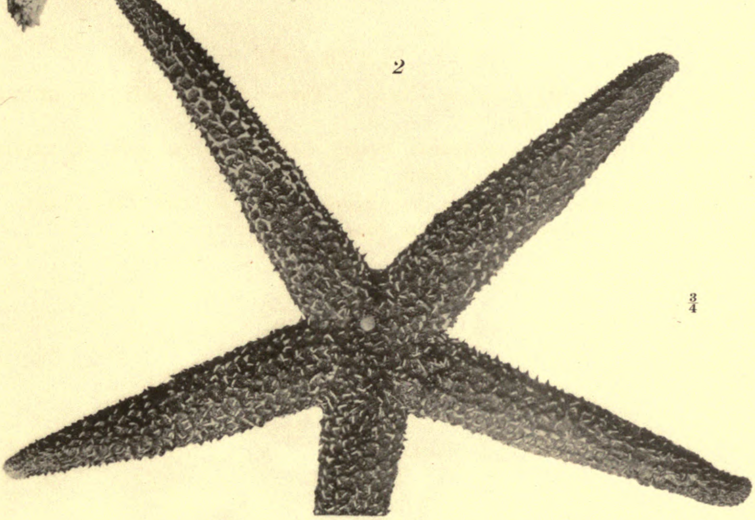
FIG. 2. *Echinaster tenuispinus* Verrill. Type. Dorsal side; ¾ natural size. La Paz. Yale Mus.

FIG. 3. *Henricia leviuscula spiculifera* Clark. Actinal side; × 1⅞. Bering Island. U. S. Nat. Mus.

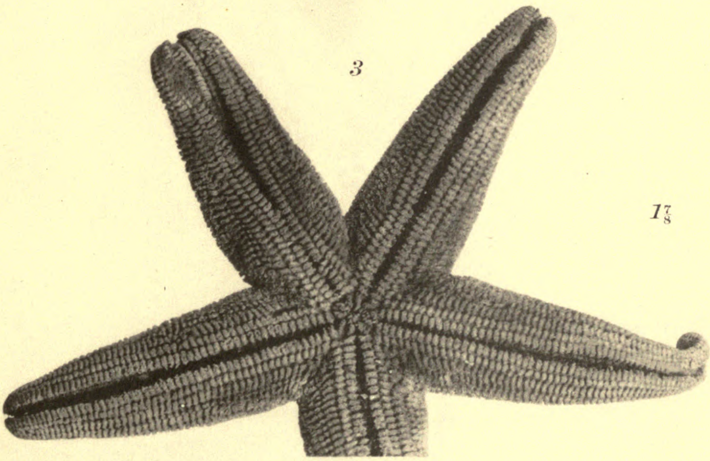
1



2



3



HELIOTYPE CO., BOSTON

1. Mithrodia bradleyi Ver. Type
2. Echinaster tenuispinus Ver. Type
3. Henricia leviuscula spiculifera (Clark)

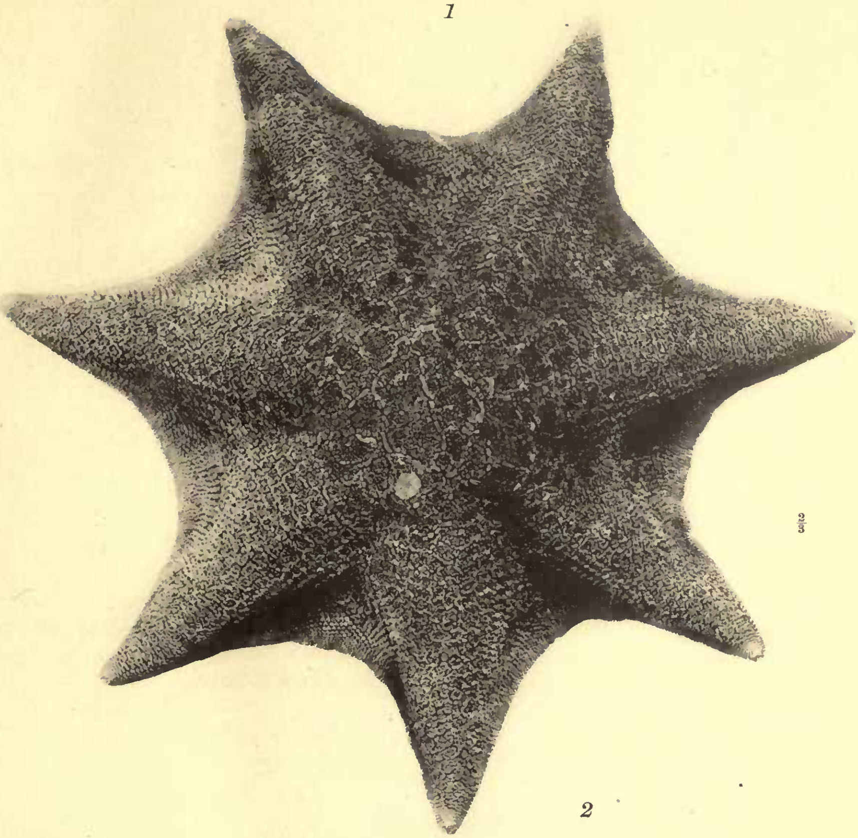
108

PLATE CVIII.

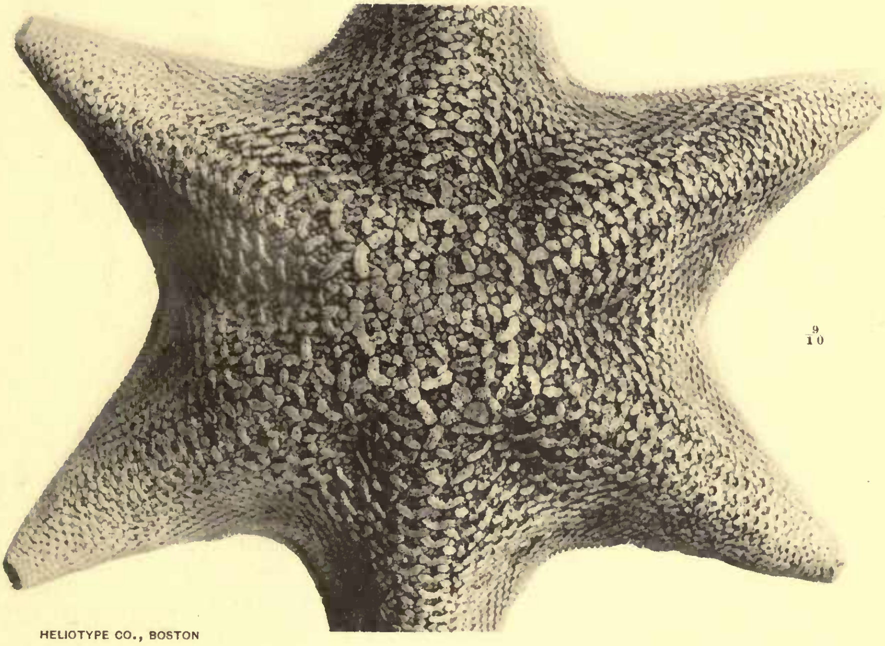
FIG. 1. *Patiria miniata* (Brandt). A seven-rayed specimen. Dorsal side; about ⅔ natural size. Departure Bay, Canada Geol. Survey.

FIG. 2. The same. A six-rayed specimen. Dorsal side; about 9/10 natural size. Departure Bay, Canada Geol. Survey.

1



2



HELIOTYPE CO., BOSTON

1. 2. Patiria miniata Ver. Varieties

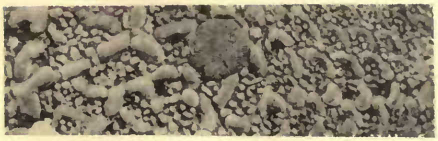
109

109

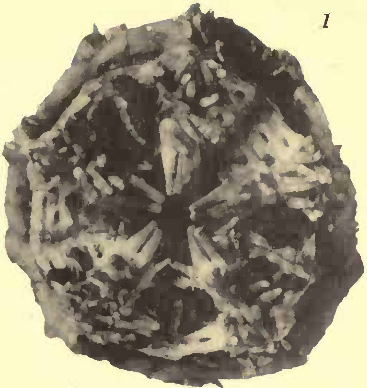
PLATE CIX.

FIG. 1.	*Orthasterias tanneri* Verrill. Cotype. Actinal side of disk, to show jaws and peroral spines; × 2⅔.
FIG. 1*a*.	The same specimen. Dorsal side of disk, showing spines and pedicellariæ; × 2.
FIG. 1*b*.	The same specimen. Section of a ray, showing inner surface of skeleton; cut through ambulacral plates and flattened out; *a, a,* ambulacral plates; *ad, ad,* adambulacral plates; *b, b,* peractinal plates; *m, m,* inferomarginals; *m′,* m′, superomarginals; *d, d,* dorso-lateral plates and transverse connective ossicles; *s, s,* adambulacral spines; *c, c,* median radial or carinal plates; × 2⅓.
FIG. 2.	*O. columbiana* Verrill. Type. Transverse section of a ray; *a, a,* ambulacral plates; *ad, ad,* adambulacrals; *b, b,* peractinals; *m, m,* inferomarginals; *m′, m′,* superomarginals; *d, d,* dorso-lateral plates and transverse ossicles; *c,* carinals; × 2.
FIGS. 2*a*, 2*b*.	The same specimen. Two parts of a transverse section of a ray, split through the ambulacral plates and flattened out, to show inner surface. Lettering as in fig. 1*b,* except that *d, d; d′ d′; d″, d″* show the three rows of dorso-lateral plates; × 2.
FIG. 3.	*Patiria miniata* (Brandt). Central part of disk and madreporic plate, with spinules removed; × 2.
FIG. 4.	*Enoplopatiria siderea* Verrill. Type. Dorsal view of middle of a ray with spinules removed; × 2.

3



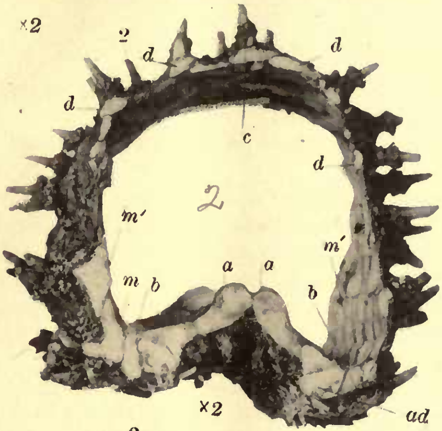
1



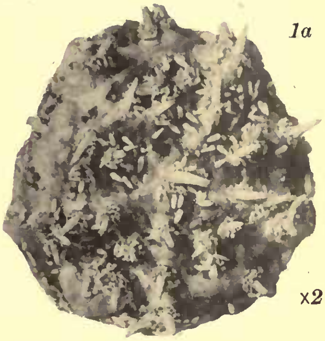
×2⅔

Tanneri

×2

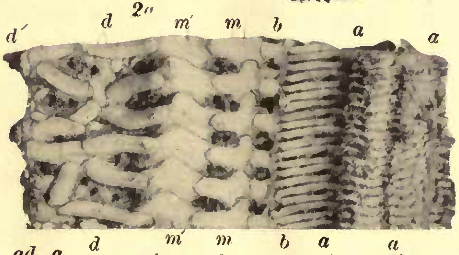


1a

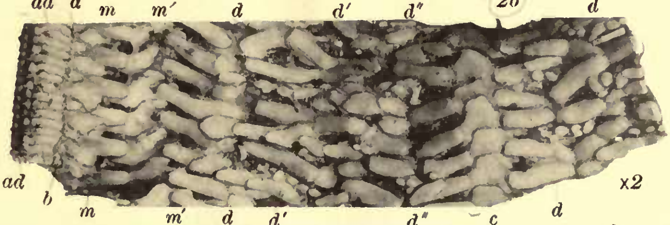


×2

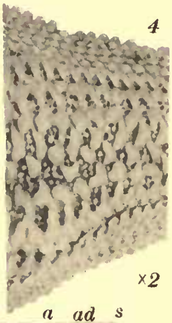
2a



2b

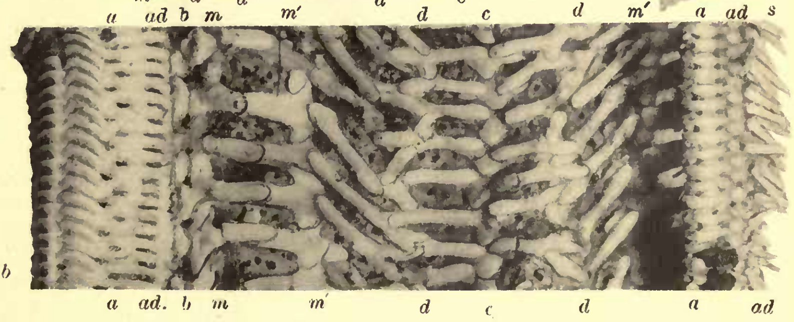


4



4

×2



×2⅓

HELIOTYPE CO., BOSTON

1-1b. Orthasterias tanneri Ver. Cotype
2-2b. O. columbiana Ver. Type
3. Patiria miniata (Br.)
4. Enoplopatiria siderea Ver. Type

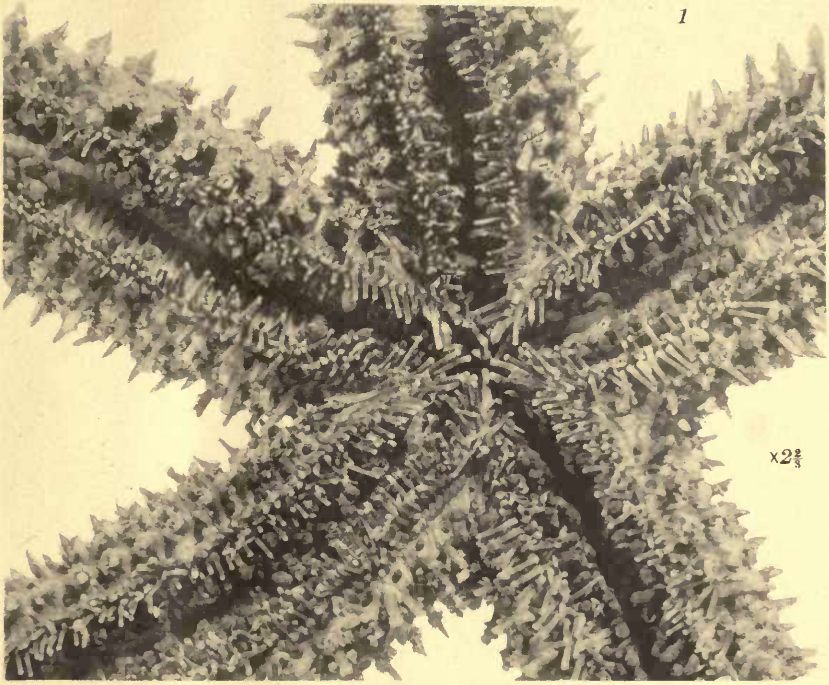
110

all

110

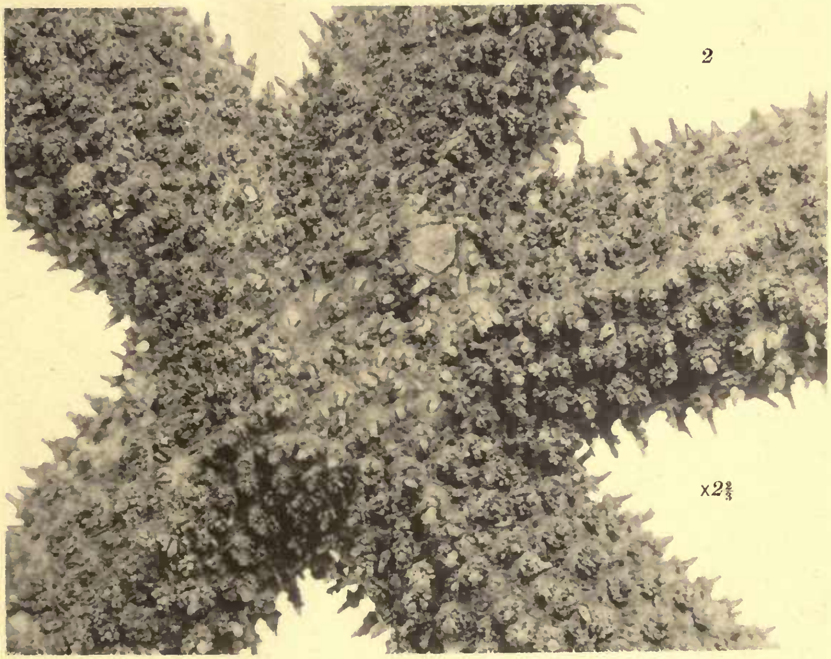
PLATE CX.

FIGS. 1, 2. *Distolasterias chelifera* Verrill. Type. Ventral and dorsal views; × 2⅔.



1

x2⅔



2

x2⅔

HELIOTYPE CO., BOSTON

1-2. Distolasterias chelifera Ver. Type

14 DAY USE
RETURN TO DESK FROM WHICH BORROWED
EARTH SCIENCES LIBRARY

This book is due on the last date stamped below, or
on the date to which renewed.
Renewed books are subject to immediate recall.

~~JUN 7 1964~~
~~AUG 7 1964~~
~~OCT 5 1964~~
~~JUN 18 1967~~

LD 21-50m-4,'63
(D6471s10)476

General Library
University of California
Berkeley

U.C. BERKELEY LIBRARIES
C034511328

— 282